HOW TO ESTIMATE

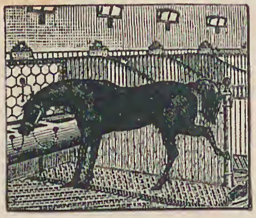
BEING

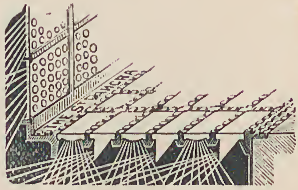
THE ANALYSIS OF BUILDERS' PRICES

J. T. REA.

SECOND EDITION

REVISED & ENLARGED





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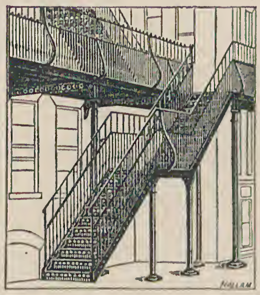

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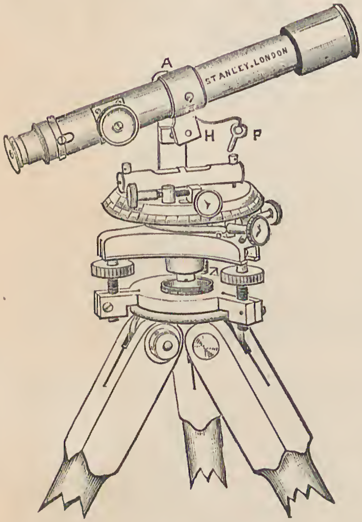

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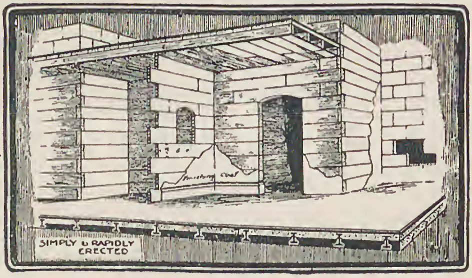

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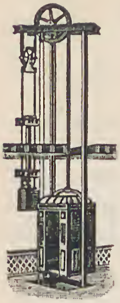

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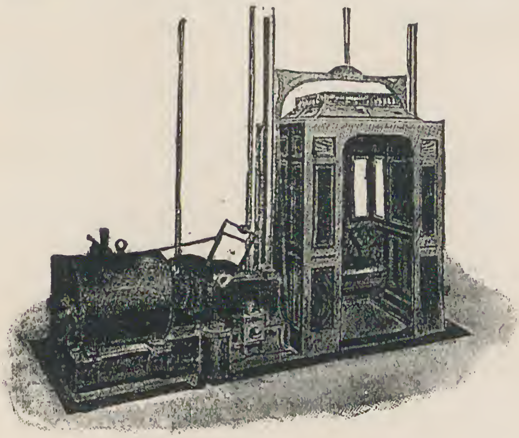

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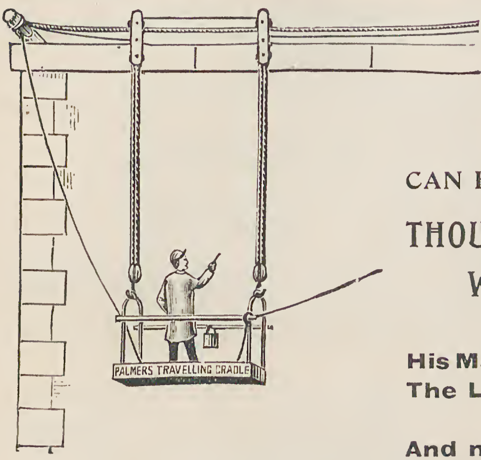

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HOW TO ESTIMATE:

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THE ANALYSIS OF BUILDERS' PRICES.

HOW TO ESTIMATE

BEING

THE ANALYSIS OF BUILDERS' PRICES

GIVING FULL DETAILS OF ESTIMATING FOR BUILDERS, AND CONTAINING THOUSANDS OF PRICES, AND MUCH USEFUL MEMORANDA

BY

JOHN T. REA

FELLOW OF THE SURVEYORS' INSTITUTION; SURVEYOR TO THE WAR DEPARTMENT.

SECOND EDITION, REVISED AND ENLARGED.

WITH FORTY-FOUR ILLUSTRATIONS

LONDON

B. T. BATSFORD, 94 HIGH HOLBORN

1904

BRADBURY, AGNEW, & CO. LD., PRINTERS
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PREFACE

TO THE SECOND EDITION.

The first edition of this book having been sold out within a year is a gratifying testimony to its utility, and in the second issue thus rendered necessary every endeavour has been made to increase its value. The chapter on "Excavator" in the former edition has now been divided into three, dealing separately with Excavator, Concretor, and Drainlayer, for greater convenience and accuracy; while in the chapter on "Cost of Buildings" over a hundred new items, with the addition of useful notes, have been inserted. The remainder of the book has been enlarged and in part re-written, while many fresh examples of analysis from actual experience have been added, and the prices throughout brought up to date. These various revisions and additions have increased the total contents of the volume by some sixty pages.

With regard to the question of varying prices, it must be remembered that costs of material and labour are perpetually changing, and that the object of this treatise is to assist the contractor in building up rates for himself in a natural way, irrespective of time or place.

J. T. REA.

December, 1903.

PREFACE

TO THE FIRST EDITION.

Estimating is undoubtedly the most important part of the builder's business. Many who tender make up their prices in a somewhat haphazard manner, often from published price-books, aided by their own judgment and experience, and without a full knowledge of the scientific methods which underlie the formulating of a true estimate. These latter methods may be termed the analysis of builders' prices, which enables contractors to calculate values for themselves by dissecting, taking asunder, and examining the various elements that go to make them up, the complete result being shown in the priced bill of quantities.

The analysis of prices has not advanced much beyond where such men as Gauthey, Anselin, Nadaud, and Blottas left the matter many years ago. It is not proposed to make this a mere handbook on builders' prices; but it is intended to serve as an introduction to the *principles* upon which estimating is based rather than to set forth standard rates, which vary according to circumstances in every locality.

For the sake of uniformity, however, the author has endeavoured to approach London values; provincial prices are generally from 5 to 15 per cent. less. In competitive tendering lower figures are often adopted.

The prices of most building materials have gone up from 20 to 30 per cent. within the last few years, chiefly through

"rings" and "corners" creating artificial values. This constant fluctuation must be borne in mind in reading this book, for what may be right this week may be wrong next, owing to a sudden change in the market. The mercurial discounts which merchants offer to contractors are alone sufficient to upset any trade list of prices, and builders wisely get quotations from time to time to ensure exactness, and these quotations vary in themselves according to the amount of the order and the standing of the customer, &c. The principles of estimating, however, still hold good as herein set forth.

The matter in this volume appeared originally as a series of articles in the *Building News*, but has been carefully revised prior to its publication in book form.

J. T. REA.

1*st October*, 1902.

CONTENTS.

CHAPTER VI.—CONCRETOR.

CHAPTER VII.—DRAINLAYER.

CHAPTER VIII.—BRICKLAYER.

CHAPTER IX.—MASON.

CHAPTER X.—PAVIOR.

CHAPTER XI.—SLATER.

CHAPTER XII.—TILER.

CHAPTER XIII.—CARPENTER, JOINER, AND IRONMONGER.

CHAPTER XIV.—SMITH AND IRON FOUNDER.

CHAPTER XV.—PLUMBER AND ZINCWORKER.

CHAPTER XVI.—PLASTERER.

CHAPTER XVII.—PAINTER.

HOW TO ESTIMATE.

CHAPTER I.—INTRODUCTORY.

Before a builder can tender properly, he must take many things into consideration, for if he is not careful a faulty estimate may mean a heavy loss and the decrease of his reputation. Low estimates, indeed, are often caused by an improper conception of what is required, and a loose consideration of the values of different features. The bills of quantities and every point in the plans and specification should be thoroughly examined, as well as the amount and class of work, and materials to be supplied. Quotations for special parts should be obtained direct from the merchants. The various markets ought also to be closely watched, so that the contractor may be quite up-to-date as regards the values of timber, metals, and other materials. A weekly list of market prices is now inserted in all the technical journals.

Within limits, it is best for a builder to obtain his materials from as few merchants as possible, such as builder's providers, as it saves trouble, lessens his accounts, and reduces his liabilities. Moreover, by sticking to particular firms greater discounts and concessions are gained, and the builder and his merchant get to know each other's requirements exactly. Such considerations are important factors in pricing.

If the work is in a distant neighbourhood, a visit should first be paid to the place, and full information obtained as to the formation of the soil, the cost of cartage, railway rates, lime, sand, gravel, bricks, wages, &c.

To be successful, a builder must strictly attend to his book-keeping, so that he can ascertain the profit and loss on various jobs, and such volumes as Debtors' Ledger, Day Book, Wages Book, Cost Book, Cash Book, Creditors' Ledger, Extra Works Book, Jobbing Book, &c., should be kept. Estimates ought always to be retained and put away, whether a job is secured or not, for they will be valuable for future reference;

and a builder should note each article sent to the ground or returned, and enter the cost opposite the item. A correct account of all labour, and how spent, should likewise be kept; and most contractors, when they have ascertained by this means precisely how much certain work costs them, and the relation between estimated and actual cost, being the loss or gain on each item, should make a record of it in their prime-cost or other ledgers. These accounts, if framed on a correct basis and carefully worked out, form the most reliable data for future tenders.

The variation in tenders for the same job is quite remarkable, and this is particularly the case when builders take out their own quantities. The chief explanation certainly lies in the fact that no proper system of estimating has been adopted, but that the clerk has relied upon a price-book, and has concocted prices which are only empirical. The object of this treatise is to show how to avoid such random methods of work.

Looking behind the scenes, there are also many unnatural causes for extreme differences in estimating. A contractor may be asked by a friendly architect to tender for an inconvenient job in the country, and, as he does not like to refuse, escapes the burden by making his prices prohibitive. On the other hand, a builder may desire work for no other reason than to keep his staff and machinery from becoming idle and going to waste, and so cuts his prices extremely low, even if he cannot make any profit. But if trade is good and the contractor has plenty of work, he will sometimes tender at exorbitant rates for the sake of abnormal profits, and there is a little custom of putting very high figures to items which cannot be omitted, and low ones to others which are likely to be reduced, so that in the end only profitable work will be left. Such trade practices are legitimate, but cannot be reckoned in a price-book.

Builders' Price-Books.

The published price-books are naturally the first resort of the inexperienced estimator; but, as a matter of fact, the trade does not rely upon them for serious pricing. They are no doubt compendiums of handy information connected with building, but the prices given are not always compiled in a scientific way. For example, some of the prices include trade discount, some do not; while others are merely list prices from merchants' catalogues. The discount in itself

largely varies, and there are two discounts: a trade discount and a discount for cash. Moreover, the percentage of profit does not appear to be uniform, and the proportions of material and labour are not shown. The diversities are innumerable, so that modifications to suit special cases are impossible.

A builder's price is broadly made up of two things: material and labour, to which may be added a third: profit. The cost of material and the cost of labour vary from time to time and from place to place, and do not fluctuate similarly. Some prices being for material only and some for labour only, and the rest for both in varying proportions, a rise in wages must affect them very differently. The manual labour is often the most expensive item in a price, as it includes the preparation of the material and fixing.

From this it is obvious that a price-book to be capable of adaptation must necessarily set out separately in each case the time occupied and the material consumed, or, which is the same thing, their values at stated rates. It is, therefore, out of the question to set up a standard of prices suitable for every edifice, as there are so many points affecting the value of the work which must be taken into consideration, and the circumstances attending the erection of different buildings are rarely alike. Such things as closeness or slackness of supervision, misunderstandings as to quality of workmanship, worrying by the architect, delay in furnishing detail drawings, differences in locality and site, frost and bad weather, sudden rises and falls in the markets, &c., will all help to alter the conditions of profit or loss for the contractor, and the extent of which no price-book can measure.

When, however, the builder has worked out a series of prices for himself, he must be on the alert for parallel cases to avoid the great labour involved in making calculations afresh every time a new estimate is made. In fact he should carefully prepare an adaptable price-book of his own, and revise it from time to time. Thus a consistency in pricing would result, which is of some consequence.

It is needless to add that it is indispensable to have a large collection of trade catalogues and circulars in the office, which should be frequently brought up to date.

Prime Cost.

The P.C., or net trade price of an article, means the prime or net cost after deducting from the merchant's list price in

his catalogue the trade discount. But it does not include the discount for cash, which is only given when the buyer pays cash down, nor carriage, fixing, and builder's profit. The definition of this expression becomes important when dealing with provisional amounts in bills of quantities, as different interpretations are put upon it, such as that the letters P.C. are intended to imply the published catalogue price. This, however, is the "list price," or L.P. of the price list.

Clause 27 of the R.I.B.A. Conditions of Contract states: —"The words 'Prime Cost' or the initials P.C. applied in the specification to goods to be obtained and fixed by the contractor, shall mean, unless otherwise stated in the specification, the sum paid to the merchant after deducting all trade discount for such goods in the ordinary course of delivery, but not deducting discount for cash, and such sum shall be exclusive of special carriage, the cost of fixing, and contractor's profit."

Trade Discounts.

As already stated, there are two discounts: a trade discount, and a discount for cash.

The former is given by firms supplying building requisites to those in the trade, and the amount varies from 2½ to over 50 per cent., but the mean of 20 to 33 per cent. is commonly allowed off all made articles. Even the discount allowed by one merchant differs according to those with whom he deals.

The discount for cash is usually 2½ per cent., and is generally conceded by wholesale firms.

Establishment Charges.

These consist of salaries to managers, clerks, &c., office expenses, supervision, depreciation of plant and machinery, rent of premises, gas, water, interest on capital, &c., which become a serious element in a large builder's business, and must be taken into consideration in the output on a new building. Establishment charges and profit should be kept separate, careful office accounts being kept of each, and both allowed for when estimating. Such charges are commonly reckoned at 5 per cent., and even as much as 7½ per cent.; or, say, 5 per cent. interest on capital, and 2½ per cent. written off each year for depreciation of plant and machinery. "Occasionally they are classed in two categories: 5 per cent.

on work done at the building, and 7½ per cent. on work done at the builder's shops " (Leaning).

Builders' prices are affected by so many things that it is next to impossible to apportion specific establishment charges to specific items of work ; therefore the most convenient way is to add a uniform rate of 5 per cent., as above, to the net cost of each item in the quantities throughout ; profit in addition.

Profit.

A net profit of 10 per cent. is the least that builders like to accept, exclusive of establishment charges, and is almost invariably added to each individual price. Therefore the total percentage to be added to each item of work would be :—

For establishment charges	5	per cent.
For profit on building work	10	,,
Total	15	,,

For work or material in small quantities, the profit should be higher, as the total expenditure in such a case is more in proportion. Therefore add 15 per cent. profit on building work (or 20 per cent. total, including 5 per cent. for establishment charges), for small jobs, up to, say, £5,000.

For jobbing and repairs, a still larger percentage is required (even up to 20 or 25 per cent.), to cover the time wasted in walking to and from the work, small quantities of stuff, more extensive supervision, &c., and for travelling expenses, lodging money, &c., when in the country. Thus, a workman may have to set a grate in a house two miles distant from his master's yard ; a third of his time is spent on the trifling task, while the remaining two-thirds are thrown away on the road.

The large contractor, who perhaps owns a brickyard or a quarry, in addition to extensive premises full of rapid-working machinery and labour-saving appliances, can naturally turn out work more cheaply and expeditiously, and at a bigger profit to himself, than the small tradesman or jerry-builder. The latter, indeed, scamps, because that is his only means of keeping himself afloat, and he cannot rival his more successful competitor. Dozens of similar doors and windows, and hundreds of feet run of moulded work in stone or wood, can be rattled out by machinery at comparatively little cost, and these, of course, are produced at a fraction of the rate of similar articles laboriously effected by hand labour. But in

any case, experience and judgment are required before a definite profit can be settled upon in making out an estimate, and the proportion is not always uniform, some items yielding a large profit and others very little.

The common assumption that the bigger an order the less the charge, and the larger the quantity manufactured the cheaper to produce, does not always apply. For instance, the Ipswich Town Council accepted a tender for 250,000 wood paving blocks, and were surprised to find a graduated rise in price per lot of 50,000, the first being cheapest. The explanation was that the merchants were unable to supply such a large number within a given time, while they found it comparatively easy to furnish 50,000 only. Hence a smaller quantity was obtainable at a cheaper rate.

With reference to the terms of payment, it is considered that the larger and the more frequent the payments on account of contract, the greater will be the facility with which the contractor can execute his work, and the lower will be the terms at which he can offer to perform it. The reserve to be deducted from each payment should never exceed 25 per cent. on the value of the work executed.

Canal Rates.

Water freights, whether by canal, river, or sea, are always lower than railway rates, and whenever possible a smart contractor should take advantage of the former, even to the extent of chartering a schooner himself and taking all his building materials as near as he can to a distant site in one cargo.

Transport by canal is cheaper than by railway, and the three principal causes are :—*First*, on a canal there is no item of cost corresponding with the wear and tear of rails, sleepers, or fittings, though the cost of maintaining banks and locks must be taken into account. *Second*, there is a corresponding saving of the repairs required by rolling stock and locomotives in consequence of their running on a rigid permanent way. *Third*, the most important reason is that the maintenance of works on a canal is much less costly on an average than the corresponding outlay on a railway, not only from the absence of vibration, but also from the smaller magnitude of the works themselves.

It is to be regretted, however, that these waterways have fallen into neglect and gradual decadence, and canal traffic seems to have declined in proportion to the development of

railways. Perhaps this may be attributed to the slowness of transit and general inability to receive large barges, yet good canal systems, like those on the Continent, are of undoubted benefit if properly managed. The reasons for the lapse appear to be—(1) That the canals are owned in comparatively short lengths by independent companies, each charging its own rate, and so introducing great confusion where long journeys are made; (2) That on all the most important canals some portions are invariably held by competing railway companies, in whose interest the rates at such points are always high; (3) That the locks and water-way vary greatly in size, necessitating corresponding variation in the boats employed, or, on long voyages, of the largest boats which can be used in the smallest canal *en route*.

A complete map of all the canals and inland navigations is embodied in the report of the Select Committee on Canals, May, 1883, Vol. 13, Parliamentary Papers. Among some of these may be mentioned the Midland Canal, the Grand Junction Canal, the Regent's Canal, the Grand Surrey Canal, all of which are connected with London. The canal system of this country is 4,000 miles in length.

The dues vary with the canal and the distance carried, as well as differing with the material. The "through" rate between London and Liverpool is 4*s.* 6*d.* per ton, for the total distance of 245 miles over nine different canals. A common English rate is ¼*d.* per mile for horse haulage, and ·03*d.* for steam haulage. A usual rate for the discharge of cargo at a London canal wharf is 10*s.* per day. Canals carry by what they call "gauge weight"—a most uncertain method—but efforts are being made to have such articles as bricks carried at computed weight, as is now done by the railways.

Railway Rates.

A knowledge of railway rates is necessary for the contractor, for these must be generally added to the cost of the goods as quoted by the merchant. Materials, too, are often worked at the builders' shops in town, and have to be sent by rail to the site. Goods sent by rail are frequently charged for at a higher rate than they should be, and the amounts are paid because they are too complicated for most people to understand. A little trouble will enable the prices to be checked, and the cheapest way to forward different articles, when considerable sums may be saved. At every

goods station a rate book is kept, accessible to the public by Act of Parliament.

Charges.—These differ with the company, as well as with the classes of materials, but the cost of conveyance is much less in proportion for long distances than for short ones. The carriage of goods on railways to port of shipment in England is generalised at 1*d.* per ton per mile, though in Belgium and Germany only ½*d.* per ton per mile. The division of charges, and the modes of measurement of different companies, leave much to be desired. For full list see the "General Railway Classification of Goods," obtainable from the chief office of each railway company, price 1*s.*

Packing.—Railway rates vary according to how articles are packed, and if unpacked the owner often has to take the risk. Allow 15 per cent. of their cost for packing and carriage of stores in the United Kingdom.

Description.—In consigning goods full descriptions should be given, as rates differ according to material. "Chimney-pieces," for example, might be of slate, marble, wood, or iron, and the cost of carriage of each of these would be very different, coming under different categories.

Goods Trains.—Articles go more cheaply by goods trains, which are slower, than by ordinary passenger trains, and there are two rates: one called "company's risk," under which the company is liable for damage; and a lower rate, called "owner's risk," under which the company is not so liable.

In goods trains merchandise is divided into eight classes—A, B, C, 1, 2, 3, 4, and 5. Classes A and B are for minerals, &c., in consignments of 4 tons and upwards; Class C for iron, steel, timber, &c., of 2 tons and upwards. Goods in Class C, under 2 tons, are charged Class 1, unless the rate "as for 2 tons" at Class C is cheaper. Classes A, B, and C do not include collection or delivery.

The rates 1 to 5 include collection and delivery within the usual boundaries, except local traffic on a few small lines, and where the trader or builder does his own carting, a refund allowance is made from 1*s.* to 2*s.* 6*d.* per ton. This drawback must be claimed, or it will not be paid. How many contractors have hauled their stuff to the station for distant jobs and never known they were entitled to any cartage allowance?

Consignments of less than 3 cwt. are charged under a "Small Parcels" scale, which is higher in proportion to the tonnage rate. Fractions of 14 lbs. are charged as 14 lbs.,

and over 14 lbs. as 1 qr. Articles in different classes in the same package are rated at the charge for the highest.

Owner's Risk.—A reduced rate of 10 to 20 per cent. can be obtained on certain goods if the sender forwards them at "owner's risk," and signs the note, thus relieving the railway company from ordinary carrier's risks, but not from wilful breakage. Such articles are divided into three classes, according to possibility of damage, and have X, Y, or Z after the number denoting their class in the "Extracts from Classification," thus:—

Stable fittings, iron or steel ...	3 X,	about 10 per cent. off.
Glass, flint	3 Y,	„ 15 „ „
Marble chimney-pieces, packed...	3 Z,	„ 20 „ „

Exceptional Rates. — These are for different kinds of materials between certain stations, under such generic terms as "hardware," &c. The exceptional or cheaper rates are frequently fenced round with such conditions as owner's risk, 4-ton lots, 4-ton loads, 2-ton lots, station to station (S. to S.) instead of collected and delivered (C. and D.), &c.

Damage.—Immediately goods are received they should be examined, and, if damaged, they should either be refused, or accepted and signed for as damaged, and a claim for the loss made on the railway company within two or three days. If it is not possible to examine them at once the words "not examined" should be added by the recipient to the delivery note; a subsequent claim will then hold good.

Returned Empties.—The scale is somewhat as follows:—Not exceeding 25 miles, 4*d.* per cwt.; 50 miles, 6*d.*; 100 miles, 10*d.*; 150 miles, 1*s.* 1*d.*; 200 miles, 1*s.* 4*d.*; 250 miles, 1*s.* 7*d.*; 300 miles, 1*s.* 10*d.*; and 350 miles, 2*s.* per cwt. Add 2*d.* to above rates if coming to or going from a London station.

Returned empties must be between the same persons and stations as when carried full by the railway, collection and delivery being included.

Builder's Materials.—The following are the classes of a few builder's materials:—

	Class.
Beadings and mouldings, gilt, lacquered, or varnished, in boxes...	3
Bricks, common and fire	B
Builder's implements, such as barrows, ladders, winches, pulleys, &c.	1
Cement	C
Chimney pots, earthenware or fireclay, in crates	C
Clay, fire	A
Colours and paints, in casks or iron drums, or in tin cases ...	2

	Class.
Drain pipes, glazed	C
Felt, asphalted	1
Glass, sheet and rolled...	3 Y
Granite in blocks, rough or undressed	B
Granite in blocks, polished or dressed	1
Joiner's work (common wood), beadings and mouldings (not gilt, lacquered, or varnished), doors and door frames, fittings and fixtures, staircases, balusters, handrails, window sashes, frames, and shutters	3 Y
Laths, wood, in bundles	C
Lead piping, in cases or casks...	1
Lead, sheet, and white lead	1
Lime in bulk	B
Limestone in bulk	A
Limestone, polished or dressed	3
Marble in blocks, rough	C
Nails and spikes, iron or steel...	C
Pipes, rainwater, or eaves-gutters, cast iron	2 Y
Roofing tiles, common...	B
Slate slabs, roughly planed and grooved, not packed	C
Stone, in the rough state	B
,, sawn, or roughly wrought up...	C
,, carved	2 X
,, decorative, carved for the interior of buildings	4 Y
Stoves, grates or ranges, common or kitchen	2 Y
,, polished or enamelled, not packed	3
,, ,, ,, packed	4 Z
Timber	C
Varnish, in casks or iron drums	2
Zinc sheets	C

For particulars of carriage of timber, see "Carpenter and Joiner," under "Analysis."

Terms and Conditions of Merchants.

The following are the principal business terms and conditions of sale as usually set forth by merchants in their catalogues, but they vary with the firm :—

Prices and Delivery.—The prices in this catalogue include (if a London firm) free delivery within town limits—*i.e.*, Carter, Paterson & Co.'s radius, about ten miles from Goswell Road—to London wharves and railway companies' termini. (It is frequently stated, "Prices quoted are, unless otherwise specified, at our works.") They are subject to alteration, without notice, in the event of any particular rise or fall in the value of materials or labour.

References.—To prevent delay, first order should be accompanied by remittance; and in order to facilitate future business, trade references should be given to well-known

firms in the United Kingdom (London houses preferred), before ledger accounts may be opened.

Remittances.—Remittances should be made payable to "—— & Co.," and cheques crossed "—— Bank."

Terms.—Accounts rendered monthly, payable during the month following, less $2\frac{1}{2}$ per cent. discount. Quarterly and running accounts, net.

Cash Discount.—A discount of $2\frac{1}{2}$ per cent. will be allowed for cash if paid within one month from the date of invoice. Prompt cash, 5 per cent.

Overdue Accounts.—No discount whatever will be allowed off overdue accounts, which, if not paid within three months, or upon application, will be charged with interest at the rate of 10 per cent. per annum.

Packages.—No charges are made for packing and direction. Packing-cases are charged extra for separately, but two-thirds are allowed for "empties" returned in good condition within fourteen days from date of invoice, carriage paid, and duly advised. The following are the usual prices inserted in invoices for packing-cases:—

	Per Ft. Super.
Packing cases, 1 in. deal, close	$3\frac{1}{2}d.$
,, ,, ,, ,, open, skeleton or crate ...	$2\frac{1}{2}d.$
,, ,, $\frac{3}{4}$ in. ,, close	$3d.$
,, ,, ,, ,, open, skeleton or crate ...	$2d.$
Add to above if zinc-lined	$4d.$

Breakage in Transit.—Goods are sent forward at railway company's risk, and if damaged goods are returned for replacement, they must be returned by same carriers, marked, "Carriage Free—Damaged in Transit." In the event of packages appearing, when delivered, to be in a damaged state, it is recommended that delivery notes be signed as "Contents Not Examined," as, in the event of damage, claims can be sustained if notice be given to carriers within three days of advice of arrival or delivery.

Deficiencies.—All goods should be carefully examined on receipt, and if any deficiency is detected it should be noted on the delivery sheet, as the carriers will not be responsible unless the shortage is pointed out at time of delivery. The delivery of any goods, properly addressed, to the carriers, will be considered as delivery to the purchasers.

Shipping Orders.—A *pro ratâ* charge of 5 per cent. on the value of the goods is made on all shipping orders, to cover cost of packing and delivery to the docks in London. If required to be delivered free on board ship in London, a further charge is made to cover shipping expenses, dock

dues, cranage, &c. If the goods are shipped from any other port than London, the cost of carriage to such port will be charged extra.

Special Quotations.—Where a quantity of goods of a similar description is required, a special quotation will be furnished on application.

The trade discount, as a rule, is not publicly stated in catalogues, but can only be obtained on private application. Its amount greatly depends on the quantity of goods ordered, and the larger the order the larger the percentage given.

Trade Abbreviations.—Note the meaning of the following initials:—

F.O.B.	means	Free on Board.
F.O.R.	,,	Free on Rail.
F.O.W.	,,	Free on Wagons.
C.I.F.	,,	Cost, Insurance and Freight.

CHAPTER II.—THE COST OF BUILDINGS.

There are five methods of ascertaining the value of buildings before erection. Four of these deal with approximate estimates, and are chiefly used by architects; the remaining one is the more exact method of precise quantities, and is the business of the quantity surveyor. These methods are:—

I. *Estimating by the Cost per Cubic Foot of Similar Buildings.*—This is the best known and most usually adopted method, because of its general convenience. The dimensions are best taken by measuring the length and breadth from out to out of walls, and the height from half foundations to half-way up the roof. The cubic contents thus obtained are multiplied by the price per foot cube of some similar building. Sometimes the height is measured from the bottom of footings (*i.e.*, top of concrete) to half-way up the roof. Cheaper attached structures, such as annexes, stables, sheds, &c., should be kept separate and priced at a lower rate; while more ornamental portions, like towers and porches, would be valued higher than the main block. Small buildings cost more in proportion than large ones of the same type.

This cubing system is open to some objections. The lumping together of voids and solids at one rate is certainly unscientific, for the same class of building may be divided into many rooms, with numerous internal solids in the shape of walls, &c., between; while another may have comparatively few chambers, creating much empty space. In fact, the proportion of voids to the solid structure is not a fixed quantity, so that the price per cubic foot can never be exactly regulated. This requires large experience and a nicety in pricing which the estimator cannot always possess. The description and quality of materials and workmanship, too, are seldom the same; neither are the conditions of contract; and these variations are frequently overlooked when a certain rate per cubic foot is assumed. Owing to these imperfections the following methods are better:—

II. *Taking Out Rough Quantities and Pricing the Items.*—This method is described in Leaning's "Quantity Surveying,"

and a "Price-Book for Approximate Estimates," by T. E. Coleman, F.S.I., Surveyor, War Department. The work should be concentrated into as few items as possible, in order to save labour, and a schedule of prices or old bills of quantities would be necessary to price these out. Though less expeditious, this is a more reliable system than pricing at per cubic foot.

III. *Estimating per Square.*—This method has been recommended by Professor Robert Kerr, F.R.I.B.A., in his "English Gentleman's House," published in 1864, and by Mr. Wheeler in his "Choice of a Dwelling," published in 1872. It has, however, been reserved for Mr. S. Alcock, F.S.I., Surveyor, War Department, to develop and fully describe this system in an article contributed to the "Occasional Papers of the Association of Surveyors of H.M. Service, July, 1894." The mode is to take the constructional shell only, pricing it at so much per 100 square feet. Walls, for instance, are taken according to their thickness and manner of finishing, including all digging, concrete, plastering, papering, &c.; floors, including joists, struttings, ceilings, &c.; roofs, including slating, lead-work, rafters, boarding, &c.; and so on—all being reckoned at per square complete. Such a system of superficial measurement appears to be more satisfactory than the cubing, as it takes into account the materials and labour in a more exact and definite form. Of course, a special list of prices must be compiled for each of these main superficies, and care and discrimination are certainly required.

IV. *Pricing per Unit of Accommodation.*—This is a somewhat rough-and-ready means of estimating the cost of such buildings as hospitals, schools, churches, stables, and other edifices, which may be respectively priced at per patient, per scholar, per sitting, and per horse. Its great utility is because the cost can be at once roughly determined without the preparation of plans. It is better, however, to check an approximate estimate by working out two or more styles, thereby insuring closer results.

V. *Estimating by Accurate Quantities.*—For full information on this head the reader is referred to such well-known books as Leaning's "Quantity Surveying" and Fletcher's "Quantities." This method is only adopted when it is intended to actually carry out the work, and usually when tenders are sent in by several builders in competition. It is very laborious, and necessitates great skill and a thorough knowledge of building construction, so that the subject is

invariably left to quantity surveyors as experts. The system is divided into the three parts of "taking off," "abstracting," and "billing," the last only being given to the contractors for the purpose of inserting their prices, when the completed bills are sent to the architect for his and his client's decision. The whole procedure is, of course, familiar to every reader of this work.

In approximate estimating add about 15 per cent. for preparation of site, roads, drainage, and water supply; $2\frac{1}{2}$ per cent. for contingencies for contract work, but 10 per cent. when the job is comparatively small, say under £500; and add 15 per cent. of their cost for carriage and packing of stores in the United Kingdom. Estimated costs of buildings do not, as a rule, include purchase of site, architect's commission, quantity surveyor's fee, furnishing, and such like extraneous expenses.

Examples.

Approximate Estimate for Building.—The following outline example will indicate how the approximate estimate for an ordinary building is summed up:—

	£
Main block, 132,500 ft. cube at 1*s.* per f.c.	6,625
Tower attached, 16,480 ft. cube at 1*s.* 3*d.* per f.c.	1,030
Outbuildings, 54,900 ft. cube at $6\frac{1}{2}$*d.* per f.c.	1,487
Buildings only	9,142
Add 15 per cent. for site, roads, drainage, and water supply ...	1,371
	10,513
Add $2\frac{1}{2}$ per cent. for contingencies	262
Total estimate	£10,775

Say, in round figures, £10,800.

Actual Estimate.—The following is the actual approximate estimate of the new Horton Asylum, as submitted in March, 1903, by the Asylums Committee to the London County Council. It is very instructive, as showing how the cost of an immense modern building group is made up:—

	£
Foundations	55,710
Superstructure	320,860
Water and gas mains	2,200
Roads	10,000
Fencing	6,000
Airing court, shelter and tar-paving	5,930
Boilers and heating system	25,400
Laundry machinery...	6,000

	£
Kitchen and baking plant	4,000
Electric lighting and water supply (inside asylum)	11,000
Fire hose and fittings	800
Internal decoration	6,500
Farm buildings	15,000
Architect and quantity surveyors...	13,000
Clerk of works, extras and contingencies	13,600
	496,000
Equipment of asylum	55,000
Additional work to Central station	10,000
New well, &c.	8,500
Total estimate	£569,500

Estimated Cost of Buildings.

The following average rates are for brick buildings erected under ordinary conditions, exclusive of land. Stone buildings cost 10 to 20 per cent. more, according to locality :—

No.	Building.	Per Ft. Cube.	Per Unit.
1.	Asylums (lunatic), including administrative and accessory buildings.	7*d.* to 10*d.*	£200 to £300 per inmate.
	Furnishing ditto	—	£20 per inmate.
2.	Barracks, officers' quarters and mess	10*d.* to 11*d.*	£800 to £950 per officer.
3.	Barracks, men's blocks	6*d.* to 7*d.*	£35 to £40 per man.
4.	Barracks, married soldiers' quarters, cottage type.	8*d.* to 10*d.*	£350 to £400 per quarter.
5.	Baths, best type, including machinery and appliances.	1*s.* to 1*s.* 2*d.*	—
6.	Breweries, about three stories and cellar, including plant, machinery, and well, but exclusive of sheds, boundary walls, gates, &c. :—		
	5-quarter brewery, total about £2,500	4*d.* to 5*d.* (inexpensive)	£500 per qtr.
	10 ,, ,, ,, £4,500		£450 ,,
	20 ,, ,, ,, £8,000		£400 ,,
	40 ,, ,, ,, £14,000	6*d.* to 7*d.* (pretentious)	£350 ,,
	70 ,, ,, ,, £21,000		£300 ,,
	Drainage in addition to foregoing ...	—	£10 ,,
	(*Note.*—" Quarters " of a brewery or malting mean that the kiln treats so many quarters of barley, from which malt is made, at one operation. A quarter = ¼ tun = 8 bushels of malt = 10 to 12 ft. cube.)		
7.	Chapels, plain, including seating ...	5*d.* to 7*d.*	£5 to £7 per sitting.
8.	Churches, including tower and seating	6*d.* to 1*s.*	£10 to £15 per sitting.

No.	Building.	Per Ft. Cube.	Per Unit.
9.	Churches, corrugated iron, lined with matchboarding.	3*d.* to 5*d.*	£2 to £4 per sitting.
10.	Conveniences, underground	3*s.* to 4*s.*	£50 to £100 per compartment.
11.	Cottages, labourers', about £200 each	4*d.* to 6*d.*	£40 to £50 per room.
12.	Cowhouses, or byres, including fittings	4*d.* to 6*d.*	£15 to £30 per stall.
13.	Distilleries, whisky or other spirit, reckoned at per 1,000 gals. output capacity per annum.	4*d.* to 7*d.*	£100 per 1,000 gals.
	Fixed plant for ditto	—	£90 per 1,000 gals.
14.	Drill halls	3*d.* to 5*d.*	—
15.	Exhibition buildings. Steel, wood and plaster.	1*d.* to 2*d.*	—
16.	Factories, exclusive of machinery ...	5*d.* to 7*d.*	—
17.	Flats, residential	1*s.* to 1*s.* 3*d.*	—
18.	Gymnasiums, including fittings ...	5*d.* to 7*d.*	—
19.	Hospitals, general, including administrative and accessory buildings.	9*d.* to 11*d.*	£300 to £450 per bed.
20.	Hospitals, infectious, ditto	10*d.* to 1*s.*	£400 to £600 per bed.
21.	Hotels, first class	1*s.* 3*d.* to 1*s.* 6*d.*	—
22.	Hotels, second class	10*d.* to 1*s.* 3*d.*	—
23.	Houses or "mansions," first class, main building.	1*s.* to 1*s.* 3*d.*	—
24.	Houses or "mansions," second class, main building.	9*d.* to 11*d.*	—
25.	Houses or "villas," third class, main building.	6*d.* to 8*d.*	—
26.	Houses, out-buildings, and offices ...	5*d.* to 7*d.*	—
27.	Infirmaries, workhouse, including administrative buildings.	7*d.* to 9*d.*	£100 to £250 per bed.
28.	Law courts	10*d.* to 1*s.*	—
29.	Libraries, public	8*d.* to 10*d.*	—
30.	Maltings, including plant and machinery, but exclusive of boundary walls, gates, &c.	3*d.* to 5*d.*	£50 to £80 per quarter.
31.	Museums, public	10*d.* to 1*s.*	—
32.	Offices, city, best class...	1*s.* to 1*s.* 2*d.*	—
33.	Post-offices	8*d.* to 10*d.*	—
34.	Prisons, complete	7*d.* to 9*d.*	£150 to £170 per cell.
35.	Sanatoria for consumptives	8*d.* to 9*d.*	£300 to £350 per bed.
36.	Schools, secondary day	9*d.* to 11*d.*	£25 to £50 per scholar.
37.	Schools, London School Board, including special and subsidiary buildings.	8*d.* to 10*d.*	£15 to £27 per scholar.
38.	Schools, Board, provincial	4*d.* to 6*d.*	£10 to £18 per scholar.
39.	Sheds, corrugated iron...	2*d.* to 4*d.*	—
40.	Sheds, waggon or cart	3*d.* to 5*d.*	—

No.	Building.	Per Ft. Cube.	Per Unit.
41.	Stables, first class, including cavalry officers'.	9*d.* to 11*d.*	£110 per stall.
42.	Stables, second class, including cavalry troop.	7*d.* to 9*d.*	£80 per stall.
43.	Stables, third class	5*d.* to 7*d.*	£50 per stall.
44.	Tenements, artisans' dwellings, London.	8*d.* to 10*d.*	£70 to £110 per room.
45.	Theatres, first class	1*s.* to 1*s.* 3*d.*	£15 to £25 per seat.
46.	Town-halls, exclusive of towers ...	1*s.* to 1*s.* 4*d.*	—
47.	Warehouses, plain	6*d.* to 9*d.*	—
48.	Water-towers, exclusive of tanks and pipes.	8*d.* to 11*d.*	—
49.	Workhouses, including administrative and accessory buildings.	7*d.* to 10*d.*	£150 to £220 per inmate.
50.	Workshops, artificers'	6*d.* to 8*d.*	—

Actual Cost of Buildings.

The following list, showing the actual cost of buildings as erected, exclusive of land, will be useful for the purposes of comparison :—

Asylums.

No.	Building.	Per Ft. Cube.	Per Unit.
1.	Average cost of fifteen asylums erected before 1845 by the Metropolitan Commissioners, London.	—	£200 per inmate.
2.	Bexley Heath Asylum, London (1898), 2,098 inmates.	—	£210 ,,
3.	Claybury Asylum, London (1893), 2,158 inmates.	—	£236 ,,
4.	Hanwell Asylum	—	£162 ,,
5.	Nottingham Borough Asylum (1876) ...	—	£170 ,,
6.	Tooting Asylum, London (1902). Nine blocks for 750 inmates. Each block three stories, with day room and offices. Three buildings for resident and domestic staff, with administrative block, laundry, engine-room, electric lighting machinery room, and boiler house, centrally. Cost of buildings, machinery, boundary walls, steam, gas, and water mains, &c., about £250,000.	—	£333 ,,
7.	Winwick Asylum, Warrington (1901). Brick buildings on pavilion system, lighted by electricity. Also a water-tower, church for 800 persons, 12 cottages, and 2 gate lodges. 2,000 inmates. Cost £583,000, exclusive of furniture.	—	£291 ,,
8.	York Asylum (1903), 360 inmates. Cost £90,500.	—	£280 ,,
9.	Temporary buildings, of wood and iron, erected by the London Asylums Committee.	—	£100 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
10.	Temporary buildings (1896), at Colney Hatch Asylum, 300 inmates. Wood and corrugated iron on brick foundations, with hot-water pipes and boiler house, offices, &c.	—	£60 per inmate.
	Equipment of ditto. £3,600 in addition	—	£12 ,,

BARRACKS.

No.	Building.	Per Ft. Cube.	Per Unit.
11.	A complete set of barracks for a battalion of infantry, including officers' quarters, men's quarters, married quarters, and all accessory buildings, as well as drainage, water supply, roads, preparation of site, &c., costs about £130,000.	—	£160 per officer and man.
12.	Canteen, Victoria Barracks, Portsmouth (1888). Total, £2,080. One story. Brick, slated roofs.	$6\frac{1}{8}d.$	—
13.	General's Quarters, Portsmouth. Two stories. Brick.	$8\frac{1}{4}d.$	—
14.	Huts, Pembroke Dock (1887). Hollow brick walls, wooden roof, boarded and slated, matchboarded ceiling. Sleeping accommodation for 16 men. Cost £280 each.	$4\frac{1}{2}d.$	£18 per man.
15.	Laundry and Washhouse, Pembroke Dock (1894). Brick walls, concrete and wooden floors, open roof, boarded and slated, including 15 washing troughs, coppers, boiler, drying closet, pump, and 1,000 gals. rain-water tank. One story. Total, £613.	$9\frac{1}{4}d.$	£41 per trough.
16.	Married Soldiers' Quarters, Pembroke Dock (1894). A block of 20 quarters, two stories and attic, with living rooms, bedrooms, sculleries, porches, w.c.'s, &c. Hollow brick walls, concrete and wooden floors, stone and wooden stairs, wooden roof, boarded and slated. Building includes an end house for pump, with C.I. tank for 6,500 gals. Total, £4,930.	$7\frac{3}{4}d.$	£247 per quarter.
17.	Officers' Stables, Victoria Barracks, Portsmouth (1895). Block with 6 stalls, including hay and straw store, saddle room, &c. Total, £1,170.	$7\frac{3}{4}d.$	£196 per stall.
18.	Warrant Officers' Quarters, Milldam Barracks, Portsmouth (1895). Block of 8 quarters. Total, £4,270.	$9\frac{1}{4}d.$	£534 per quarter.

CHAPELS, NONCONFORMIST.

(Cost includes tower, spire, and seating.)

No.	Building.	Per Ft. Cube.	Per Unit.
19.	Rye Hill, Newcastle, 1,150 sittings. Stone walls, internal construction chiefly wood and iron.	$3\frac{1}{8}d.$	£2 10*s.* 6*d.* per sitting.

No.	Building.	Per Ft. Cube.	Per Unit.
20.	New Barnet, 300 sittings. Brick walls, stone dressings, no columns.	$4\frac{1}{6}d.$	£3 17*s.* 4*d.* per sitting.
21.	Algernon Road, Lewisham, London, S.E., 310 sittings. Brick walls, stone dressings, tiled roof.	$5\frac{1}{3}d.$	£3 17*s.* 6*d.* per sitting.
22.	Urmston, near Manchester, 350 sittings. Stone walls, stone turret and spire, no columns.	5*d.*	£4 14*s.* 4*d.* per sitting.
23.	Bourton-on-the-Water 320 sittings. Rubble walls, brick lining, brick arches, stone piers and tracery.	$5\frac{3}{8}d.$	£5 12*s.* 6*d.* per sitting.
24.	Westgate Road, Newcastle, 850 sittings. Stone walls, piers, arches, tracery, pulpit, turret and spirelet, green slates.	$5\frac{1}{3}d.$	£6 3*s.* 4*d.* per sitting.
25.	Dulwich Grove, London, S.E., 570 sittings. Brick walls, stone tracery, wooden columns inside, tiled turret.	$5\frac{2}{3}d.$	£6 3*s.* 10*d.* per sitting.
26.	Poole Road, Bournemouth West, 570 sittings. Brick walls, stone tracery, turret, tiled roof.	5*d.*	£6 18*s.* 8*d.* per sitting.
27.	Jesmond, Newcastle, 550 sittings. Stone walls, nave piers and moulded arches, central tower, stone pulpit, roof carried by cross arches of stone, green slates, marble baptistery.	$7\frac{2}{3}d.$	£9 12*s.* 9*d.* per sitting.

CHURCHES.

No.	Building.	Per Ft. Cube.	Per Unit.
28.	Bryn Church, Glamorganshire (1902), 650 sittings. Early English style, local stone with Bath stone dressings, interior lined with red bricks, tesselated floor, pitch pine roof, tiled. Total, £6,500.	—	£10 per sitting.
29.	Congregational Church, Primrose Hill, Northampton (1902), 500 sittings. Octagon shape, dome roof, supported by four angle arches, gallery at end, pitch pine pews. Total, £2,800.	—	£5 12*s.* 0*d.* per sitting.
30.	Macroy Memorial Presbyterian Church, Antrim Road, Belfast (1894—5), 950 sittings. Brick walls, red sandstone dressings, slated roof, varnished pitch pine internal woodwork, seats circular on plan, gallery, small bore water heating, gas lighting. Total, £4,300.	$5\frac{1}{2}d.$	£4 10*s.* 6*d.* per sitting.
31.	Presbyterian Church, Liscard, Cheshire (1902), 450 sittings. Ruabon brick, stone dressings, lighted by electricity. Total, £3,730.	—	£8 5*s.* 10*d.* per sitting.
32.	Presbyterian Church, Tooting, London (1902), 720 sittings. Square plan, 58 ft. by 58 ft., with organ, galleries, tower, and spire, steel trussed roof, boarded and slated, wood-block flooring, fire-proof	—	£11 2*s.* 3*d.* per sitting.

No.	Building.	Per Ft. Cube.	Per Unit.
	staircase, brick walls, stone dressings. Total, £8,000.		
33.	Roman Catholic Church, New Ross, Ireland (1901), 1,500 sittings. Early English style, nave, aisles, double transepts, deep chancel, two side chapels, sacristry and vestry, tower and spire 200 ft. high, local stone walls, with Bath and Portland stone inside, relieved with Irish marbles, floors of wood-blocks and tiles, marble altars, organ, confessionals, screen, &c. Total, £22,000.	—	£14 13*s.* 4*d.* per sitting.
34.	Roman Catholic Church, Stanley, North England (1902), 650 sittings. Early English style, local stone, pitch pine roof, stained windows, terrazzo pavement, wood-block flooring, electric light. Total, £7,000.	—	£10 15*s.* 5*d.* per sitting.
35.	Roman Catholic Church, Withington (1901), 450 sittings. Byzantine style, length, 100 ft., width across transepts, 68 ft., height, 60 ft. throughout, high tiled dado all round, electric light. Total, £15,000.	—	£33 6*s.* 8*d.* per sitting.
36.	St. James's Church, Muswell Hill, London (1901), 950 sittings. Total, £13,000.	—	£13 13*s.* 8*d.* per sitting.
37.	St. John's Church, Ballyclare, co. Antrim (1902—3), 180 sittings. Brick walls, red sandstone dressings, slated roof, varnished pitch pine internal woodwork. Total, £1,050.	5¾*d.*	£5 5*s.* 7*d.* per sitting.
38.	Salvation Army Hall, Lisburn, near Belfast (1903). Corrugated iron building on brick plinth foundations, timber framework, sheeted interior, platform, lavatory, no fittings.	2*d.*	—

Conveniences, Underground.

39.	Three underground conveniences, Shoreditch, costing on an average £2,000 each Concrete floor with tiles, stone steps, pavement, lighted roof with steel joists, w.c.'s, urinals, and lavatory fittings.	3*s.*	£65 per compartment.

Cottages.

40.	Cottages for farm labourers, Fareham (1895). Superior type, semi-detached pair, each containing parlour, kitchen, scullery, larder, and three bedrooms, as well as earth closet, coals, &c., rooms average 8 ft. 6 in. high, hollow brick walls, tiled roofs. Total per pair, £530, or £265 each.	5¼*d.*	£53 per room.

No.	Building.	Per Ft. Cube.	Per Unit.
41.	Cottages for farm labourers, Privett Farm, Gosport (1888). Three cottages, each containing living-room, scullery, larder, entrance passage, three bedrooms, earth closet, &c., rooms average 9 ft. high, hollow brick walls, slated roofs. Total, £570, or £190 each.	4¼*d.*	£48 per room.
42.	Cottages at Leek, Staffordshire (1901). Two terraces of 48 cottages, two stories, brick walls, tiled roofs, tiled kitchen floor, bath, bay windows of wood and plaster :—		
	Class A.—Frontage 13 ft. 9 in., five rooms each, with entrance lobby. Cost, £198 per cottage, plus £10 10*s.* for roads and drains.	3¾*d.*	£40 ,,
	Class B.—Similar, but without lobby, and kitchen and scullery smaller. Cost, £187 10*s.* per cottage, plus £10 10*s.* for roads and drains.	3⅝*d.*	£38 ,,
43.	Cottages for working classes in towns. Built in rows, 15 ft. frontages, two stories high, and containing living room, kitchen, scullery, coals, w.c., and three bedrooms.	—	£200 each.
44.	Cottage Flats, Arley Street, Liverpool (1897) Built in three blocks, each two stories high, and consisting of 83 rooms, in 34 tenements. Each floor forms a separate flat of three and four rooms, with a separate entrance direct from the street, rooms 8 ft. 6 in. high, brick walls, wooden floors.	4¾*d.*	£66 per room.
45.	Municipal Cottages, Richmond, Surrey (1894). Two stories, white brick with red facings, red tiled roofs :—		
	Class A.—22 six-roomed cottages, in one block of four and three blocks of six each. Cost, £254 per cottage, plus £16 for roads and drains.	5¼*d.*	£43 ,,
	Class B.—28 four-roomed cottages, in two blocks of eight and two of six each. Cost, £190 per cottage, plus £12 for roads and drains.	5⅝*d.*	£48 ,,
	Class C.—6 double tenements, or 12 cottage flats, two and three-roomed dwellings, in two blocks of three each. Cost, £324 per double tenement, plus £16 for roads and drains.	6½*d.*	£65 ,,
	Second scheme, erected in 1900 :—		
	40 cottages, Class A., 6 rooms each, £276, plus £18 as above.	5⅔*d.*	£46 ,,
	14 cottages, Class B., 4 rooms each, £240, plus £13 as above.	6⅘*d.*	£60 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
	16 cottages, Class D., 5 rooms each, £245, plus £15 as above.	5¾*d.*	£49 per room.
	Labour on these cottages cost 42 per cent. of the whole, and bricklayers' work 34 per cent.		
	(*Note.*—In reckoning cost of rooms, only living-rooms and bedrooms are counted, accessories, such as sculleries, larders, w.c.'s, coals, &c., being ignored.)		
	EXHIBITION BUILDINGS.		
46.	Glasgow Exhibition (1901). All temporary buildings, constructed of steel, wood, and fibrous plaster :—		
	Industrial Hall	1½*d.*	£2 8*s.* per y.s.
	Grand Avenue	⅞*d.*	£1 2*s.* ,,
	Machinery Hall	¾*d.*	16*s.* ,,
	Concert Hall	2½*d.*	—
	Restaurants	2*d.*	—
	FLATS.		
47.	Flats, South Audley Street, London. Stone and terra cotta, fireproof floors, hardwood finishings, enriched plasterwork, &c.	1*s.* 2*d.*	—
	HOMES.		
48.	Cottage Homes for Children, Sidcup, for the Greenwich Union (1902). Four blocks for 50 boys each, two blocks for 12 boys each, twenty blocks for 15 girls each, and two blocks for 20 probationers each ; also isolation block, steam laundry, swimming bath, and gymnasium, and electric light generating station. Total, £107,000.	—	£190 per child.
49.	Cottage Homes or Schools, Hornchurch, for the Shoreditch Union. Eleven cottages, each for 30 children, with workshops, swimming bath, infirmary, &c.; 337 children altogether. Total, £51,000.	—	£151 ,,
	HOSPITALS.		
50.	Abergavenny Cottage Hospital (1902). Nine beds in hospital, and there is also an outdoor department, comprising waiting room, consulting room, and dispensary. Walls of brick and terra cotta, terrazzo floors, and tiled roof. Total, £1,925.	—	£214 per bed.
51.	Belfast Royal Victoria Hospital (1900—3), 315 beds. Brick walls, stone dressings, wards side by side (not in separate pavilions), with mechanical ventilation on the plenum system. Total about £100,000.	—	£300 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
52.	Birmingham General Hospital (1892—1901), 346 beds. Buildings treated in a marked architectural character, and include a detached nurses' home for 100 nurses, a large out-patients' department, chapel, and a complete installation of mechanical ventilation on the plenum system. Cost of buildings, including foundations, architects' commission, surveyor's fees, and salary of clerk of works, was £140,000. Total cost, including land, buildings, furnishing, legal and incidental expenses, was £210,000, or £607 per bed.	9*d.*	£405 per bed.
53.	Brook Hospital, Shooter's Hill, London, 600 beds. Brick walls, ward pavilions two stories high, teak floors, electric light. Infectious hospital.	—	£470 ,,
54.	Chorlton Union Hospital, for workhouse	—	£50 ,,
55.	Heathcote Infectious Hospital, Leamington.	—	£385 ,,
56.	Herbert Hospital, Woolwich, military, including administrative buildings.	—	£320 ,,
57.	Isolation Hospital, co. Kildare (1903), 18 beds. Comprises three one-storied blocks, with administrative block in centre, and male and female block on either side. Annexes to each ward block. Brick walls, wooden and concrete floors, wooden roofs boarded and slated.	9¾*d.*	£246 ,,
58.	Isolation Hospital, Maidstone (1902). A temporary building for 12 beds at the sanatorium. Total, £374.	—	£31 ,,
59.	Isolation Hospital, Northfleet, Gravesend (1902). A temporary building for 12 beds. Total, £300.	—	£25 ,,
60.	Isolation Hospital, Skipton (1902), 42 beds. Four separate blocks. Total, £16,000.	—	£381 ,,
61.	Isolation Hospital, Tanfield (1902), 32 beds. Administrative block in centre, with separate wards for males and females on either side, connected by long corridors. Stone walls, terrazzo floors. Total, £8,000.	—	£250 ,,
62.	Isolation Hospital, Tippethill, Bathgate, N.B. (1901), 28 beds. Two pavilions and two observation wards. Total, £8,500, including building and furnishing.	—	£304 ,,
63.	Isolation Hospital, Trowbridge, Wilts (1903), 30 beds. Total, £6,984.	—	£233 ,,
64.	Isolation Hospital, Willesden	—	£380 ,,
65.	Isolation Hospital, Worksop (1902), 16 beds. Four blocks, comprising administrative, 12-bed ward, 4-bed ward, and	—	£297 ,,

No.	Building.	Per Ft Cube.	Per Unit.
	laundry. Brick walls, tiled roof. Total, £4,745.		
66.	Netley Hospital, military, including administrative buildings, 1,054 beds. Brick walls, stone dressings, deal floors, slated roof.	—	£305 per bed.
67.	Portsea "Lying-in" Hospital	—	£192 ,,
68.	St. Thomas' Hospital, London (1870). Eight blocks, four stories, connected by open arcades. Brick walls with stone dressings. Total cost about £400,000, including administrative buildings. Over 600 beds.	9*d.*	£650 ,,
69.	Ditto, one pavilion, without administrative buildings.	—	£250 ,,
	HOTELS.		
70.	Burlington Hotel, Bangor, co. Down (1901). Four stories and attic. Brick walls, rendered outside with cement to imitate stonework, highly treated, elaborate interior fittings. Total, £6,000.	6*d.*	—
71.	Great Central Hotel, Marylebone Road, London.	10½*d.*	—
72.	Holborn Viaduct Hotel. Brick walls, stone facings.	1*s.* 4*d.*	—
73.	Hotel Victoria, Northumberland Avenue, London. Ashlar facing, lined with brick. Eight stories, 500 apartments.	1*s.* 6*d.*	—
	HOUSES.		
74.	Additions to house in Oxfordshire, on spur of Chiltern Hills (1903). Wing with residential and sleeping rooms, offices, &c.	9*d.*	—
75.	Dwelling-house, Chelsea (1902). Stock brick walls, green slated roof, stables beneath.	11*d.*	—
76.	Dwelling-house, Orpington, Kent (1900–1). Three stories, rooms averaging 15 ft. by 12 ft. Red brick walls, tiled roof. Total, £1,200.	1*s.* 0*d.*	—
77.	Farm Residence, co. Meath (1896). Two stories. Walls mainly of masonry, partitions and chimney breasts of brick, finished externally with cement plaster, with architraves, pilasters, pediments, frieze, &c. All stone, lime, sand, and cartage supplied by owner.	4½*d.*	—
78.	Farm Offices, co. Meath (1896). One and two stories. Walls entirely of masonry, pointed, dressings to doors and windows of facing bricks, half timber gables. All stone, lime, sand, and cartage supplied by owner.	3¼*d.*	—

No.	Building.	Per Ft. Cube.	Per Unit.
79.	Terrace house, Cliftonville Road, Belfast (1896). Brick walls, superior facings, slated roof. Total, £930.	$4\frac{3}{4}d.$	—
80.	Terrace houses in various parts of Belfast (1898—1903). Cost £250 to £400 each, and letting at £25 to £40 and taxes. Brick walls, no stonework, slated roofs, and containing 2 reception and 4 bedrooms.	$4\frac{1}{4}d.$	—
81.	Villas in various parts of Belfast (1900—3). Cost £500 to £750 each, and letting at £40 to £55 and taxes. Brick walls, no stonework, slated roofs, and containing 2 reception and 5 bedrooms.	$4\frac{3}{4}d.$	—
82.	Ditto. Cost £750 to £1,000 each, and letting at £55 to £75 and taxes. Brick walls, no stonework, slated roofs, and containing 3 reception and 6 bed rooms. (*Note.*—Building is cheap in Belfast.)	$5\frac{1}{2}d.$	—
83.	Villas at Helen's Bay, Bangor, co. Down (1902—3). Cost over £1,000 each, and letting at £100 to £150 and taxes. Brick and stone treatment, with about 3 or 4 reception and 6 bed rooms.	6*d.* to 7*d.*	—
84.	Villa for Medical Officer and Public Dispensary, Ballymore, co. Antrim (1897). Brick walls, superior facings, slated roofs. Total, £750.	4*d.*	—
85.	Ditto, at Crumlin, co. Antrim (1902). Same description. Total, £837.	$5\frac{1}{2}d.$	—
	INFIRMARIES.		
86.	Axbridge Infirmary for Workhouse, Somerset (1902), 60 beds. Total, £5,720.	—	£95 per bed.
87.	Cannock Infirmary for Board of Guardians, Staffs. (1901), 48 beds.	—	£96 ,,
88.	Liverpool Royal Infirmary...	—	£622 ,,
89.	Skipton Infirmary, adjoining the Workhouse (1901). Total, £4,300.	—	£90 ,,
90.	Solihull Workhouse Infirmary and Tramp Wards (1901), 80 beds. Red brick walls, stone dressings, tiled roofs, oak block and tile floors.	—	£85
91.	St. Pancras Infirmary, Highgate	—	£68 ,,
92.	West Ham Infirmary, Leytonstone, London, N.E. (1903). Administrative block in centre, with two ward blocks on either side, connected by covered corridor; 674 beds. Also boiler-house, laundry, machinery building, nurses' home for 72 nurses, ambulance and stable buildings, mortuary, water-towers, chapel for 200, &c. Local red bricks, Bath and Portland stone dressings, green slated	—	£277 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
	roofs, glazed brick dadoes, fire-proof construction, terrazzo floors, electric lighting, eleven lifts, &c. Total, £186,665.		
93.	Willesden Infirmary for Parish Workhouse (1903). Administrative block in centre, with two ward blocks on either side, each two stories high, two receiving wards for male and female patients, two observation wards, block comprising laundry, engine, and boiler-house, &c., lunatic wards, lying-in wards, stables, mortuary, porter's lodge, &c.; 400 beds, *i.e.*, 150 sick and 250 workhouse inmates. Yellow stock-brick walls, slated roofs, fire-proof and terrazzo floors, hot-water heating and fires, electric lighting. Total, £98,280.	—	£245 per bed.
	LAW COURTS.		
94.	Manchester Assize Courts	9½*d.*	—
	MUNICIPAL LODGING HOUSES.		
95.	Darwen Municipal Lodging House (1898). Cubicles for 110 men and 20 women; charge per night, 5*d.* Total cost of building and furnishing, £7,920.	—	£61 per bed.
96.	Glasgow Municipal Lodging Houses (seven) (1871—9). Cubicles for 2,166 men and 248 women; charge per night, 3½*d.* and 4½*d.* Total cost of buildings and furnishing, £107,000.	—	£44 ,,
97.	London Municipal Lodging House, Parker Street, Drury Lane (1893), 324 beds; charge per night, 6*d.* Total cost of building and furnishing, £22,135.	—	£68 ,,
98.	Manchester Municipal Lodging House (1899). 363 beds; charge per night, 6*d.* Total cost of building and furnishing, £25,678.	—	£71 ,,
99.	Salford Municipal Lodging House, Bloom Street (1894), 285 beds. Consists of two main blocks, each four stories high, with a connecting landing and staircase above ground floor; contains large hall, day-room, dining-room, kitchen, shops, baths, lavatories, wash-houses, sanitary conveniences, &c. Above ground floor are six dormitories, 12 ft. high, divided into a total of 285 cubicles by sheet steel partitions, allowing a space of nearly 600 cub. ft. per lodger. An external fire escape has been provided. Charge per night, 6*d.* Total cost of building and furnishing, £16,880.	—	£59 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
	MUSEUMS.		
100.	British Museum, London (1823—52). Stone walls, classic style, main frontage 370 ft. long. Total, about £1,500,000.	1*s*. 6*d*.	—
	OFFICES, CITY.		
101.	City Offices, Gracechurch Street, London Stone front, fire-proof floors, stone staircase, faïence passages, hydraulic lift, &c.	1*s*. 1*d*.	—
	POLICE COURTS.		
102.	Bow Street Police Station, London ...	11*d*.	—
	POST OFFICES.		
103.	General Post Office, North (new buildings), St. Martin's-le-Grand, London (1890). Italian style, four main stories, faced with Portland stone, but glazed brick in courtyard; floors of concrete with steel joists, asphalted flat roofs: area of floor space, 152,820 sq. ft. Total, £170,000.	8½*d*.	—
	PRISONS.		
104.	Pentonville Prison, London, N. (1840—2). Brick walls, stone dressings.	—	£162 per cell.
	PUBLIC BUILDINGS.		
105.	Birmingham Exchange and Offices ...	6*d*.	—
106.	Foreign Offices, London (1860—70). Classic style, stone walls.	1*s*. 1*d*.	—
107.	Houses of Parliament (1840—60). Perpendicular Gothic, stone walls, very elaborate. Site occupies an area of 8 acres, and the entire range of buildings is 900 ft. long and 300 ft. wide. There are 1,100 apartments, 100 staircases, and 11 open courts. Victoria Tower is 75 ft. square and 330 ft. high; Clock Tower, 44 ft. square and 320 ft. high.	2*s*. 6*d*.	—
108.	Royal Exchange, London (1841—4). Total, about £180,000.	11*d*.	—
	SANATORIA.		
109.	Sanatorium for Consumptives, Hohenhonnef, Germany, 100 patients. Total, nearly £72,000.	—	£660 per bed.
110.	Additions to Sanatorium, Eastbourne (1902), 30 patients. Two pavilions, single story, red brick walls. Total, £5,800.	—	£193 ,,

Schools.

No.	Building.	Per Ft. Cube.	Per Unit.
111.	Belfast. Ballymacarrett Mixed School under National Board (1898). Two stories, plain brick walls, open roof with sheeted interior and covered with red tiles.	4¾*d.*	—
112.	Barrow-in-Furness. Vickerstown Board School (1901), 648 children. One story, central hall system, brick walls with stone dressings, glazed brick dadoes, lighted by electricity. Total, £8,075.	—	£12 per scholar.
113.	Brownhills Board School, Staffs. (1902), 240 children. Total, £2,321.	—	£10 ,,
114.	Clapham High School for Girls (1902), 450 scholars and 80 student teachers. Red brick walls, stone facings, with gymnasium, tennis courts, kindergarten, art studios, science rooms, offices, &c. Total, nearly £15,000.	—	£28 ,,
115.	Croydon. Thornton Heath Board School (1900), 1,200 scholars. One and two stories, upper floor of concrete and steel girders, Leicestershire brick walls, Derbyshire stone dressings, tiled roof, glazed brick dadoes, yellow deal woodwork, gas light, &c. Total, £15,534.	—	£13 ,,
	Furnishing cost £732 in addition ...	—	12*s.* 2*d.* ,,
116.	Drogheda Board School (1898). One story and small basement. Walls of rubble masonry, cement plastered externally and lime plastered internally, brick partition walls and movable wooden partitions, projecting porches.	4*d.*	—
117.	Ely Board School (1902), 360 scholars. Renaissance style, red facing bricks, with Bath stone dressings. Total, £4,300.	—	£12 per scholar.
118.	Fletton Board School, Hunts. (1900), 240 infants and 360 mixed scholars = 600 total. Central hall system Fletton brick walls, Ketton stone dressings. Total, £6,000.	—	£10 ,,
119.	Halifax. Battinson Road Board School (1901), 1,000 scholars. Buildings only, £14,720.	3¾*d.*	£15 ,,
	Ditto, with mechanical ventilation ...	4⅝*d.*	£18 ,,
	Ditto, including cost of site, buildings, heating, ventilating, furnishing, and architect's commission, £31,550.	8*d.*	£32 ,,
120.	Hornsey Schools, London. Brick walls, wood-block floors, &c.	7½*d.*	—
121.	Liverpool. Birchfield Road Board School (1901), 1,690 scholars. Central hall, swimming bath, gymnasium, and	—	£21 per scholar.

No.	Building.	Per Ft. Cube.	Per Unit.
	provision for science, cookery, and laundry instruction, plenum ventilation. Total, £35,000.		
122.	London Board Schools. Buildings only.	$8\frac{1}{2}d.$ to $9\frac{1}{2}d.$	£15 per scholar.
123.	London School Board. Average cost of 450 schools from foundation of Board in 1870 to 1902. Brick buildings, three or four stories. Detail:—		
	Site, including legal and surveyor's charges		£ s. d. 7 4 0 ,,
	Buildings, including cookery, laundry, manual training, special school, or other centres, and all adjuncts, as well as superintendence		15 4 10 ,,
	Furniture and fittings charged to capital account		0 11 2 ,,
	Total ...		23 0 0 ,,
124.	London School Board. Cost of 13 schools opened in 1901—2, average about 980 scholars each, and involving a total expenditure, including sites, buildings, and furniture, of £476,530. Detail:—		
	Site, including legal and surveyor's charges		£ s. d. 9 13 3 ,,
	School buildings only, and superintendence, about		14 0 0 ,,
	Adjuncts, such as drainage, playgrounds, boundary walls, schoolkeeper's house, cookery, laundry, manual training, special school, or other centres, and superintendence, about		13 1 0 ,,
	Furniture and fittings, charged to capital account		0 15 9 ,,
	Total ...		37 10 0 ,,
	Allow 10 per cent. for cost of furniture and expenses of architect's department.		
125.	London School Board. Average cost of enlarging ten schools in 1901.	—	£17 ,,
126.	London School Board. Broadwater Road School (1903). Graded school, three stories, 960 scholars; special school, 60 scholars. Drawing class-rooms, science rooms, schoolkeeper's house, hot water heating and open fires. Total, £20,950.	—	£20 ,,
127.	London School Board. Brownhill Road School (1903). High grade school, three stories, 864 scholars; also junior	—	£22 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
	mixed and infants' school, two stories, 508 scholars. Drawing class rooms, science rooms, school keeper's house, hot water heating and open fires. Total, £30,580.		
128.	London School Board. Forest Hill School (1901). 908 scholars. School buildings only.	—	£16 per scholar.
	Ditto, on total of builder's work, including a manual centre.	—	£24 ,,
129.	London School Board. Kensington Avenue Schools, East Ham (1901), 1,573 scholars. Total, £20,520.	—	£13 ,,
130.	London School Board. Middle Row Junior Mixed School (1903), 422 scholars. Heating by open fires. Total, £8,000.	—	£19 ,,
131.	London School Board. Plumstead School (1901), 830 scholars. School buildings only.	—	£20 ,,
	Ditto on total of builder's work ...	—	£27 ,,
132.	London School Board. South Grove School (1903), 1,082 scholars. Three stories, hot water heating and open fires. Total, £21,520.	—	£20 ,,
133.	Newark-on-Trent. Balderton Infant School (1902), 300 scholars. Total, £3,150.	—	£11 ,,
134.	Ramsbottom Board School (1901), 600 scholars. Total, £8,500.	—	£14 ,,
135.	Rochdale. Heybrook Board School (1900), 1,120 scholars. Two stories, central hall, electric light. Total, £18,000.	—	£16 ,,
136.	Rudry School, Glamorganshire (1902), 170 children. Total, £1,600.	—	£9 ,,
137.	Rutherglen Burgh Public School (1902). Renaissance style, three stories, 1,000 pupils. Total, £13,000.	—	£13 ,,
138.	St. Peters-in-Thanet Board School (1902). 122 infants and 214 girls. Two stories, brick walls, covered playground. Total, £2,500.	—	£7 ,,
139.	Walthamstow Methodist Sunday School, London (1901). Assembly hall and class rooms for total of 1,100 children; gallery, separately approached by two fireproof staircases, open timbered roof, plastered walls, pine dado, incandescent lighting, &c. Also caretaker's apartments, school kitchen, offices, heating chamber, &c. Total, £3,500.		
	Cost for assembly hall only	—	£3 3*s.* 0*d.* ,,
	Cost for class rooms only	—	£4 7*s.* 6*d.* ,,

No.	Building.	Per Ft. Cube.	Per Unit.
140.	West Wycombe Board School, Bucks. (1902), 150 scholars. Total, £1,470.	—	£10 per scholar.
141.	Wishaw Board School (1902), 644 scholars. Central hall. Total, £6,000.	—	£9 ,,
142.	Riding School, Lisburn Road, Belfast (1898). Size, 150 ft. × 30 ft. × 18 ft. high to eaves. Plain brick walls, open sheeted roof with iron trusses, cinder floor covered with peat litter.	3*d.*	—
	TENEMENTS.		
	Tenement dwellings for working classes, or artisans, are divided into:—(1) Associated tenements; (2) Self-contained tenements; (3) Cottage flats; (4) Self-contained cottages; (5) Lodging houses; and (6) Combinations of fore-going.		
143.	Glasgow Tenements (1898). Two-room and kitchen house, with scullery and bath-room, built on the balcony plan, stone walls. Cost, £45 per ft. of frontage.	5*d.*	—
144.	Glasgow Tenements (1890—1900). One or two room tenements in 4-story blocks on balcony system, of stone generally. Larger rooms than London tenements, but construction and appurtenances inferior:—		
	Haghill Tenements (1900), stone ...	$4\frac{1}{4}$*d.*	£70 per room.
	Kirk Street Tenements (1896), stone	$5\frac{1}{2}$*d.*	—
	Morris Square Tenements (1895), stone.	$5\frac{1}{4}$*d.*	£71 per room.
	Saltmarket Tenements (1890), brick	$5\frac{1}{3}$*d.*	£92 ,,
	St. James' Road Tenements, No. 2 (1897), stone.	6*d.*	£93 ,,
	St. James' Road Tenements, No. 3 (1900), stone.	$4\frac{3}{4}$*d.*	£70 ,,
145.	Liverpool. — Dryden Street Tenement Houses (1900):—		
	Type A.—Contains one 4-room tenement on ground floor, and four 2-room tenements on upper floors, as well as scullery, w.c., &c. Three stories, brick walls, unplastered rooms, balcony along back on first floor.	$8\frac{1}{4}$*d.*	£67 ,,
	Type B.—Contains two 2-room tenements on ground and upper floors, as well as scullery, w.c., &c. Three stories, brick walls, unplastered rooms, balcony along back on first floor.	7*d.*	£59 ,,
146.	Liverpool.—Fontenoy Street Block Dwellings. Like Glasgow style, staircase walls of glazed brick, rooms 9 ft. high.	7*d.*	£63 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
147.	London. Tenements as designed by the London County Council Works Department. Usually four main stories with roof story, but also 2-story cottage tenements for the same class. Contain 2-room, 3-room suites, &c., each having w.c. and scullery. Ceilings 8 ft. 6 in. high, living rooms seldom exceed 144 ft. super. Brick walls, fireproof construction, concrete floors on iron joists, slated or tiled roofs, staircases lined with glazed bricks, sculleries, &c., rendered in cement :—		
	First class tenements	$9\frac{3}{4}d.$	—
	Second ,, ,, ...	9*d.*	—
	Third ,, ,, ...	$8\frac{1}{2}d.$	—
148.	London. Average cost of tenements erected during 1901, with 3, 4, or 5 stories.	—	£80 to £90 per room.
149.	London. Boundary Street Block Dwellings, Bethnal Green (1893—7). Largest scheme undertaken under the Housing Acts, 15 acres of slums being cleared. Twenty-three new separate blocks, divided into five classes of buildings, mostly with 2 and 3 rooms, brick walls, stone dressings. Total for buildings, £280,000.	9*d.*	£107 per room.
150.	London. Beaufort Street Dwellings, Chelsea (1903). Five blocks, each six stories, with a total of 261 tenements, comprising 583 rooms for 933 persons. Total, £65,000.	—	£111 ,,
151.	London. Hayles Trust Tenements, St. George's Road, Southwark (1898). Block of dwellings having a common staircase, with two 3-room tenements to each staircase landing. Let at 7*s.* per week.	$8\frac{1}{2}d.$	£70 ,,
152.	London. Cottage-flat Dwellings, Lisson Grove. Four stories, each tenement having separate entrance and staircase, and 5 rooms.	$6\frac{1}{2}d.$	£60 ,,
153.	London. Millbank Tenements (1899—1902). For 4,434 persons, 5 stories, mostly with 2 and 3-room tenements, with independent scullery and conveniences. (Seventeen blocks in all were erected on this estate at a cost of—Land, £22,242; approaches, roads, and open spaces, £22,960; buildings, £206,959; total, £252,161. The site cost £2,500 per acre.)	8*d.*	£87 ,,

No.	Building.	Per Ft. Cube.	Per Unit.
154.	London. Waterlow's Industrial Dwellings	$7\frac{1}{2}d.$	—
155.	London. Demolitions and clearing slums in central districts for new tenements.	—	15*s.* to 17*s.* per f.s.
	Ditto, per head of new occupation ...	—	£38 per head.
	When cleared the land is worth ...	—	10*s.* per f.s.
156.	London. Actual cost of sites for re-housing have ranged from	—	£3 to £22 per y.s.
	But in the majority of cases have fluctuated between	—	£3 to £6 „
	Averaging £125 per room erected.		
	The cost of these sites, however, is "written down" to a "housing valuation" varying from	—	10*s.* to £3 „
	Or £10 to £25 per room erected.		
	The average site area per room erected was 25 yds. super.		
	THEATRES.		
157.	Brixton Theatre, London, 2,000 seats Brick, stone dressings, electric light.	—	£15 per seat.
158.	York Grand Opera House (1901), 1,500 seats. Total, £24,000.	—	£16 „
	TOWN HALLS.		
159.	Enniskillen Town Hall, co. Fermanagh (1897). Two stories, with basement and attic. Walls faced with ashlar stone-work, with brick backing; lower story rusticated, projecting porticoes, stone columns, pilasters, pediments, moulded strings, balustrade on parapet, &c., in Renaissance style; tower, with angle turrets, six stories and basement, lead-covered dome, ventilating flêche, building heated by hot-air system. Total, £11,000.	7*d.*	—
160.	Holborn Town Hall and District Board Offices (1879), frontages 124 ft. and 100 ft. Free Italian style. Public hall accommodates 1,200 persons, clock tower 100 ft. high. Walls red brick and Portland stone. Total, £26,000.	1*s.* 2*d.*	—
161.	Portsmouth Town Hall. Portland stone walls, fireproof floors.	1*s.* 2*d.*	—
	WAREHOUSES.		
162.	Warehouses, Drapery, London. Stone front, fireproof floors.	1*s.* 1*d.*	—
163.	Warehouses, Thames Street, London. Brick walls, unplastered, wood floors.	7*d.*	—
164.	Warehouse, Hope Street, Belfast (1900). Plain brick treatment, heavy iron girders and columns, no interior fittings, 5 stories. Total, £3,100.	$5\frac{1}{2}d.$	—

WORKHOUSES.

No.	Building.	Per Ft. Cube.	Per Unit.
165.	Greenwich Workhouse, Grove Park, London, S.E. (1900), 816 inmates. Twenty blocks united by covered ways, chapel, laundry, bakery, &c. Total, £175,000.	—	£215 per inmate.
166.	Hastings Workhouse (1902), sleeping accommodation 338 inmates. Three main blocks, administrative being central, workshops, bakery, laundry, boiler-house, chimney shaft 80 ft. high, casual ward with 44 compartments, porter's offices, &c. Sussex brick walls, Bath stone dressings. Total, £55,000.	—	£163 ,,
167.	Isleworth Workhouse, Middlesex (1901), 800 inmates. Administrative block, porter's lodge, chapel, separate blocks for men and women, old married couples' quarters, stabling, engine-room, electric light, fireproof staircases, &c. Walls of London grey stock bricks, stone dressings, slated roofs. Buildings, £82,630. Total cost, including furnishing, £100,000.	—	£125 ,,
168.	Southmead Workhouse, Westbury-on-Trym (1902), 110 inmates and 24 casuals. Five main blocks, with offices, male and female tramp wards, married quarters, workshops, hot-water heating, infirmary for 24 patients, with boundary wall nearly half a mile long and infectious hospital outside. Buildings, furnishing, and machinery cost £29,000, and site, 13½ acres, £3,700.	—	£216 ,,
169.	Stamford Workhouse (1902), 175 inmates. Five groups of buildings, faced with stone and local bricks, glazed brick dadoes, electric lighting, slated roofs. Total, £30,000.	—	£170 ,,
170.	Wolverhampton Workhouse (1902), 1,230 inmates, including infirmary and imbecile wards. Brick walls, slated roofs.	—	£146 ,,

Considerations affecting Cost.—The area of a building greatly influences the price, as the smaller the space inclosed the greater will be the cost of the brickwork, &c., in comparison with the cubic contents. Again, a building of two or more stories is cheaper in proportion than a building of only one story, as so much excavation, roofing, &c., are saved.

Work done in small quantities is worth more than that done in large quantities—usually 20 to 25 per cent. more.

Relationship of Trades.—Two-thirds of the cost of a building are for carcase; the remaining third is for finishings. Brickwork may be taken roughly at about one-third of the total cost; carpenter and joiner nearly the same.

Only a very rough idea can be given of the percentage of cost of each trade to the total cost of building work, as it varies with the materials and design, but for ordinary brick dwellings it may be taken as follows:—

	Per cent.
Excavator and Concretor	4
Drainlayer	2
Bricklayer	33
Mason	1
Slater or Tiler...	7
Carpenter and Joiner	30
Smith and Founder	5
Plumber and Zincworker	6
Plasterer	6
Painter, Glazier, and Paperhanger	5
Sundries	1
	100

The speculating builder sublets a good many trades and their branches, employing piecework as much as possible, which means a minimum of cost and trouble everywhere.

Method of Erection.—Closely connected with the cost of a structure is the method adopted for its erection. The cheapest and best is a contract on quantities; next a contract without quantities (on drawings and specification); then measured work with a schedule of prices; and, least advisable, the direct employment of workmen supervised by the building owner's clerk of works. In the latter case the cost of the building will probably come out 20 or 25 per cent. more than a contractor would have done the work for, partly because the employer has none of the large plant and facilities which a contractor always possesses, and partly because he is unable to obtain materials at trade discounts and wholesale prices.

For Government works, such as barracks and forts, where the executed quantity will often be uncertain or small, a schedule of prices is invariably made the basis of a contract, the job being measured on completion. One of the best is the War Department Schedule of Prices, which is revised triennially, and there are also schedules of prices published

annually by H.M. Office of Works and the London School Board. In France, a similar publication is the "Série des Prix," which forms the basis of tenders for municipal works in Paris, and which is thoroughly arranged and treated.

Architects and builders are advised, for their own sakes, to keep a notebook, setting forth the cost of buildings designed or erected by them, and giving such particulars as time of erection, estimated cost, highest tender, lowest tender, and actual cost as finished. An office record of this sort is simply invaluable.

House Property.—The rent of a first-class town dwelling may be calculated at about 5 per cent. on its cost of building. From the gross rent take off the following "outgoings" or "deductions," to obtain the net rent. Rates and taxes must also be considered, according to whether they are paid by landlord or tenant.

	Per cent.
For repairs or renewals deduct from rental ...	5 to 10.
For collection of rents and management deduct from rental	2½ to 5.
For casualties, risk through loss of tenants or rent, deduct from rental	2½ to 12½.
For insurance, deduct from rental	1*s.* 6*d.* to 5*s.*

The higher percentages are for small tenements, which are more troublesome and occasion greater risk.

To capitalise the value of property:—Divide 100 by the rate of interest obtainable, *e.g.*, 100 ÷ 5 per cent. interest = 20 years' purchase of the net rental.

EXAMPLE.

	£	*s.*	*d.*	£	*s.*	*d.*
Freehold premises at gross annual rent of...				100	0	0
Outgoings or deductions payable by owner:						
Taxes	1	5	0			
Repairs or renewals at 10 per cent. ...	10	0	0			
Collection and management at 2½ per cent.	2	10	0			
Casualties at 2½ per cent.	2	10	0			
Insurance at 5*s.* per cent. = ¼ per cent.	0	5	0			
				16	10	0
Net annual income or net rental...				83	10	0
To pay 5 per cent.—equal to 20 years' purchase						20
Gross value				1,670	0	0
Allowance for capital outlay upon immediate repairs or alterations				30	0	0
Capitalised value				£1,700	0	0

CHAPTER III.—LABOUR.

The ratio of labour to material is an important factor in the calculation of the value of builder's work, and good or bad artisans may frequently make the difference between profit and loss on a building. Idle and indifferent workmen always mean a loss to their employer, and this has been emphatically brought home to the writer after four years' experience on Government works in the West Indies, where it was found that the economy of execution wholly depended on the strict supervision of the negro. The British mechanic, however, is capable and energetic when he likes to exert himself, but trade unions have lessened the amount of his work, and by insisting upon a uniform rate of wages have reduced the good operative to the level of the indifferent one. This, and the risk which contractors run as a result of the various trades disputes, have caused a general advance in rates to meet contingencies. Wages have increased, while the working hours have been reduced. The increased cost of building is also due to the liabilities incurred under the Employers' Liability Act, 1880, and the Workmen's Compensation Acts, 1897 and 1900, as well as to the exacting building regulations now in force, and to the greater conveniences and ornamentation in present-day houses.

Proportion of Labour to Materials.—For good housework the labour is about 47 per cent., and materials about 53 per cent., of total cost. In building 70 two-story municipal cottages at Richmond during 1894 and 1900, it was found that the cost of labour was 42 per cent. of the whole. The following table shows the proportion which labour and materials bear to each other in the different trades :—

Trade.	Labour.	Materials and Plant.
Excavator	90 per cent.	10 per cent.
Concretor	17 ,,	83 ,,
Drainlayer	33 ,,	67 ,,
Bricklayer	30 ,,	70 ,,
Mason	50 ,,	50 ,,
Slater	15 ,,	85 ,,

Trade.	Labour.	Materials and Plant.
Tiler	20 per cent.	80 per cent.
Carpenter	30 ,,	70 ,,
Joiner	60 ,,	40 ,,
Smith	23 ,,	77 ,,
Plumber	25 ,,	75 ,,
Plasterer	60 ,,	40 ,,
Painter	50 ,,	50 ,,
Glazier	15 ,,	85 ,,

Wages.—Wages and hours alter according to locality and season, and, it may be added, according to strikes; but, generally speaking, the time is 9 hours per day in summer and 8 to 8½ hours in winter, with 5 hours on Saturday in summer and 4½ hours in winter. This may be taken at 53 hours per week in summer, and 44 to 47 hours in winter. The trade unions are constantly dictating lesser hours and higher wages, and there is a tendency of the men and unions to act on the belief that they benefit themselves by restricting the output in order to raise the rates. The National Association of Master Builders issue statements from time to time as to the condition of trade, showing the state of the labour market and giving comparative lists of the hours worked per week, and the rate of wages in the various branches of the building trade throughout the United Kingdom.

The following are the average current rates of wages per hour :—

Table of Wages.

Trade.	London.	Country.
	d.	*d.* *d.*
Excavator	7½	5 to 7
Ganger	8	6 ,, 7
Carter or Driver	6½	5 ,, 6
Labourer, General	6½	4 ,, 6
Watchman, Day or Night	6½	5 ,, 6
Bricklayer	10½	8 ,, 9
Bricklayer's Labourer	7	4 ,, 6
Scaffolder	7½	5 ,, 6½
Mason	10½	8 ,, 9
Mason, Granite or Marble	11¼	8½ ,, 9½
Mason's Labourer	7	4 ,, 6
Stone Carver	16	12 ,, 14
Pavior	10	7 ,, 8½
Slater and Slate Mason	10½	8 ,, 9

TABLE OF WAGES—*continued.*

Trade.	London.	Country.
	d.	*d.* *d.*
Slater's Labourer	7	4 to 6
Tiler	10½	8 ,, 9
Tiler's Labourer...	7	4 ,, 6
Carpenter	10½	8 ,, 9
Carpenter's Labourer	7	4 ,, 6
Joiner	10½	8 ,, 9
Smith	10½	8 ,, 9
Smith's Labourer	7	4 ,, 6
Bellhanger	10½	8 ,, 9
Plumber	11	8 ,, 9½
Plumber's Mate	7	5 ,, 6½
Zincworker	10½	8 ,, 9
Zincworker's Labourer...	7	4 ,, 6
Plasterer	11	8 ,, 9½
Plasterer's Labourer	7	5 ,, 6½
Painter	8½	7 ,, 8
Grainer or Writer	12	9 ,, 10
Gilder	12	9 ,, 10
Glazier	10	7 ,, 8½
Paperhanger	9	7 ,, 8½
Gasfitter	10½	8 ,, 9
Gasfitter's Labourer	7	4 ,, 6

The "London District," within which is the agreement as to wages and hours of labour between the Central Association of Master Builders of London and the various unions' operatives, is twelve miles, measured in a straight line from Charing Cross. This limit has been adopted by the Works Department of the London County Council. For plumbers, the term "London District" means six miles' radius from Charing Cross.

Overtime.—Overtime in London, when worked at the request of the employers, but not otherwise, is paid at the following rates:—From leaving-off time until 8 p.m., time and a quarter; from 8 p.m. to 10 p.m., time and a half; after 10 p.m., double time. On Saturday, the pay for overtime from noon to 4 p.m. is time and a half; and after 4 p.m. and Sunday, double time. Christmas Day is paid the same as Sunday.

Sent from Shop or Job.—Men who are sent from the shop or job, including those engaged in London and sent to the country, are allowed as expenses 6*d.* per day for any distance over 6 miles from the shop or job, exclusive of travelling expenses, time occupied in travelling, and lodging money.

Notice to Leave.—One hour's notice to be given, or one hour's time to be paid, by either side, on terminating an engagement.

Tide Work.—For tide work the work in water or liquid mud is allowed as ordinary time and a third; work interrupted by tides is allowed as ordinary time and a half; and when work is in water and interrupted by tides double ordinary time will be allowed. The contractor finds water-boots without extra charge.

Labourers' Attendance.—Each mechanic will require a portion or the whole of a labourer's time to attend upon him in supplying material, &c., to the spot. The usual allowance, taking an average over all the work, is one labourer to one artisan, and this is the rule observed by the trade societies. Painter's work is often performed by a labourer, as well as whitewashing, &c., which means a considerable saving. Taking down old walling and timbering can likewise be frequently done equally well by labourers.

Interference with Trades.—This is sometimes serious, and means delay, as the following cases will show:—A builder had to do a large amount of plain tiling upon a roof. This was formerly done by tilers, who understood their work, but the bricklayers said that was their job, and struck. The building was thus kept back for many weeks.

In another instance a stone template was required to be laid. The bricklayer, in getting on with his work, was not allowed to lay the template, but a mason who was on the other side of the building had to be brought round to put it in position, and then went back to his masonry.

Constants of Labour.

Constants of labour are valuable when it is required to ascertain the time it will take a man to execute a particular class of work. They are useful in making approximate estimates, and are based on the principle that a man works a certain average amount per hour or per day, as the case may be. Constants, however, cannot be relied upon for work as a whole, as they only represent the actual labour expended upon a certain piece of work, and do not cover that wasted in the intervals between for rest and miscellaneous occupation. Those given in Fletcher's "Quantities" and in Hurst's "Architectural Surveyor's Handbook" are for the hour. These latter are simply invaluable, and are the best yet formulated in this country,

indicating great thought and long experience. Gauthey, in his valuable work, "Traité de la Construction des Ponts," has also given very many constants from experiments made upon the labours of French workmen.

Constants are simply multipliers, and one has only to multiply the rate per hour or per day by the corresponding constant to find the price of the labour on any item. To this must be added the cost of the material, and the total will give the estimated prime cost of the work, to which would be affixed the 15 per cent. profit.

1. For example, when the constant is given by the hour:—

	Constant
Excavating in gravel or hard ground, per yard cube ...	1·5 hours.

An excavator gets $7\frac{1}{2}d.$ per hour; therefore—

$7\frac{1}{2}d. \times 1{\cdot}5 = 11\frac{1}{4}d.$	prime cost per yard cube.
–	cost of material.
$1\frac{3}{4}$	add 15 per cent. profit.
$13d.$	total price per yard cube.

2. The same example, when worked out by the constant for the day of ten hours, would appear:—

	Constant.
Excavating in gravel or hard ground, per yard cube ...	·15 day.

An excavator gets $7\frac{1}{2}d.$ per hour $\times$ 10 hours $=$ 6$s.$ 3$d.$ per day: therefore—

$6s.\ 3d. \times {\cdot}15 = 11\frac{1}{4}d.$	prime cost per yard cube.
–	cost of material.
$1\frac{3}{4}$	add 15 per cent. profit.
$13d.$	total price per yard cube.

How are the constants arrived at? The following will explain:—If a mason can saw 12·5 super. feet of stone per day of 10 hours (whole sawing), the constant will be obtained if we divide 1 day by the number of feet he has sawn, or $1 \div 12{\cdot}5 = {\cdot}080$ of a day.

In the same way we can find the constant for any particular work. Take, for example, the constant for laying 4-in. pipe. This is obtained in the following manner:—It has been found by careful observation that a bricklayer and labourer can lay 100 feet of 4-in. socket-pipes in a day of 10 hours; so if we divide 1 day by the length of pipe laid, we get $\frac{1}{100} = {\cdot}010$, the constant of labour of a day.

The practical estimator seldom makes much use of constants, as he generally refers to former priced bills of

quantities, private notes, merchants' quotations, &c., to enable him to make up his prices. Little use is therefore made by the author of constants in this book, as they are often ridiculously minute as regards the number of decimal places, though they serve as a mathematical guide in the adaptation of time.

The cases given are very simple ones, and have been purposely chosen to illustrate the first application of these factors. Perhaps, on the whole, owing to the smallness of most items, it is handiest to use constants dealing with the decimal parts of hours than those treating of the fractions of days, especially as the latter vary, being longer in summer and shorter in winter. Different authorities give different constants, according to how they regard the capabilities of the workmen; but those of Hurst and Fletcher may be regarded as fairly accurate.

CHAPTER IV.—PRELIMINARY AND PROVISIONS.

Before proceeding to the various trades, it will be well to discuss the various items which appear under the above heading as a preface in a bill of quantities, as these require to be analysed quite as much as builders' prices for other work. Those items that do not require to be thus dissected have been omitted.

Copy of Quantities for Architect.

"Extras and omissions to be valued at the prices of the contract, for which purpose a fully priced and moneyed out copy of the quantities shall be deposited with the architect, and any item of extra work which does not exactly agree with descriptions of the original estimate to be valued at a price analogous thereto."

This is understood, and it is not usual to enter any sum against such item, as the small extra expense is covered by the amount put down for "Cost of lithography and expenses" at the end of the bill of quantities.

Foreman.

"The contractor to keep an approved and responsible foreman constantly on the works."

On no person connected with a building job does so much really depend as upon the foreman, for he is, in fact, the chief supervisor and general factotum. It is to his intelligence and ability that all good work is due, for he is responsible for good or bad workmanship and materials, and for the diligence or slothfulness of the men under him. He keeps the accounts of the quantity of stuff used, and renders the daily and weekly returns of the number of men employed, when there is no clerk of works. Generally he rises from the ranks of the carpenters, but often from the bricklayers or masons. The general prices are best calculated without taking the foreman into account, and the cost of his maintenance should be kept separate. In order that he may finish the works properly, rather more than the stated

period of erection should be allowed for his wages, which may be averaged at £3 per week.

In addition to the general foreman there is the foreman bricklayer, &c., and the timekeeper, for a large job. For extras, when more than ten men are employed the foreman's time may be also charged; but when less are employed one of the men usually receives an additional penny per hour as leading hand, and this is charged in the bill.

Water for the Works.

"Allow for supplying water for all the works, including fees, temporary plumbing, and storage of water."

Water is always required on the works for mixing mortar, concrete, wetting bricks, plastering, &c., and in provincial towns, when supplied by a local water company, it is generally put down at about £4 or £5 per job of medium size. If in country places, the water can often be conveniently obtained from adjacent rivers or lakes, or a well may have to be dug, and the water drawn or pumped up, in which case the use of the pump and hose must be included. The hire of a 4 in. to 6 in. diam. wrought-iron contractor's pump is 7*d*. per week after the third week, plus 5*s*. chain hire; but a large contractor would possess his own plant of this sort. Taking water supplied in London by meter at 1*s*. per 1,000 gal., we have less than ¼*d*. for a yard of concrete.

London has hitherto been supplied by eight water companies (now handed over to the London County Council as the Metropolitan Water Board), each publishing its own set of regulations and charges, which differ extremely, and the details of which may be obtained on application. The opening of the ground, connection with the main, and reinstating, is always made by the company's servants, for which a charge is made, varying in different localities. These eight companies are:—The Chelsea, New River, Grand Junction, Kent, West Middlesex, East London, Southwark and Vauxhall, and Lambeth. The average cost is 7*d*. per 1,000 gals. In the provinces the average of forty county boroughs is 6*d*. per 1,000 gals., including the sums required for the repayment of capital. The charges for temporary water-supply are based on different values as follows:—

Chelsea.—5*s*. in every £100, or ¼ per cent., of estimated cost of building, to be paid in advance.

The charges for opening and reinstating ground, making the connection with the company's main, &c., are made in accordance with the Board of Trade Regulations, and under Act of 10 Vict. c. 17 (Water Works Clauses Act, 1847).

LAYING ON NEW HOUSES.

				s.	d.
$\frac{1}{2}$ in. connection, opening and reinstating ground, tapping main, &c.				10	0
$\frac{5}{8}$ in.	do.	do.	do.	12	6
$\frac{3}{4}$ in.	do.	do.	do.	15	0

A stop-cock provided by the company to be fixed by the builder on the "communication pipe" outside the premises in a position indicated by the company's officer. The company will provide and fix a suitable cover box for the protection of the same.

A union screw ferrule will be provided by the company for making the connection with their main.

All leaden pipes must be provided by the builders, and all wiped joints made by them; but, if required, arrangements can be made with the company to do the plumbing work necessary in fixing the stop-cock.

The Act of Parliament requires that 14 *days' notice* should be given previous to laying on new supplies.

TESTING FITTINGS.

If the builder requires a supply for testing the fittings, a charge of 10*s.* will be made for a fortnight's supply in addition to the above laying-on charges.

RE-LAYING HOUSES.

When the supply is required to be relaid, the company's charges (which may in special cases be exceeded), including the plumber's work, and all other necessary fees, must be paid before the supply can be reinstated. These charges will vary according to the nature of the work and the roadway.

New River.—Reckoned upon the estimated cost of building:—

£100	10*s.* each.	£325	32*s.* each.
125	13*s.* ,,	350	35*s.* ,,
150	15*s.* ,,	375	38*s.* ,,
175	18*s.* ,,	400	40*s.* ,,
200	20*s.* ,,	450	42*s.* ,,
225	23*s.* ,,	500	45*s.* ,,
250	25*s.* ,,	600—700	50*s.* ,,
275	28*s.* ,,	800—900	60*s.* ,,
300	30*s.* ,,	1,000—1,200	70*s.* ,,

Above £1,200, 5*s.* per cent. additional.

Grand Junction.—Charges on estimated cost of building:—

£100 and under £500	8*s.* 0*d.*	per cent.
500 ,, ,, 1,000	7*s.* 0*d.*	,,
1,000 ,, ,, 3,000	6*s.* 0*d.*	,,
3,000 ,, ,, 10,000	5*s.* 0*d.*	,,
10,000 ,, ,, 20,000	4*s.* 0*d.*	,,
20,000 ,, ,, 30,000	3*s.* 0*d.*	,,
30,000 and above	2*s.* 6*d.*	,,

Kent.—A printed notice has to be filled in for building supply, with the estimated cost of building. A charge of 12*s.*, including ½-in. ferrule stop-cock and screw-box, is made for connection, and the company is not responsible for repairs to roads, &c. Per estimated cost of building:—

Not exceeding £100			...	10*s.* each.
Exceeding £100 and not exceeding £150			...	15*s.* ,,
,, 150	,,	,, 200	...	20*s.* ,,
,, 200	,,	,, 250	...	25*s.* ,,
,, 250	,,	,, 300	...	30*s.* ,,
,, 300	,,	,, 350	...	35*s.* ,,
,, 350	,,	,, 400	...	40*s.* ,,
,, 400	,,	,, 500	...	45*s.* ,,
,, 500	,,	,, 600	...	50*s.* ,,
,, 600	,,	,, 700	...	55*s.* ,,
,, 700	,,	,, 800	...	60*s.* ,,
,, 800	,,	,, 900	...	65*s.* ,,
,, 900	,,	,, 1,000	...	70*s.* ,,
,, 1,000	,,	,, 1,100	...	75*s.* ,,
,, 1,100	,,	,, 1,200	...	80*s.* ,,

Above £1,200 by special agreement.

West Middlesex.—A printed form has to be filled in for building supply, with the estimated cost of building. Charges are payable in advance, at 5*s.* per cent. on the estimated cost of building. The company's expenses of laying on the supply have to be paid for at the time the connection is made, at the rate of 10*s.* for opening ground and providing ferrule. Their charge for houses is 3*d.* in the £ on the rental value of the house, for six months' use.

East London.—No printed schedule for building supply is issued: but particulars of works to be executed have to be filled up on form supplied. Rates are 1*s.* per rod on brickwork, and 1*d.* per yard cube on concrete.

Southwark and Vauxhall.—Charges for water supply for building purposes on estimated cost of building:—

£100 ...	10*s.* each.
125 ...	13*s.* ,,
150 ...	15*s.* ,,
175 ...	18*s.* ,,
200 ...	20*s.* ,,
225 ...	25*s.* ,,
275 ...	28*s.* ,,
300 ...	30*s.* ,,
325 ...	32*s.* ,,
350 ...	35*s.* ,,
375 ...	38*s.* ,,
400 ...	40*s.* ,,
450 ...	42*s.* ,,
500 ...	45*s.* ,,
600 to £700 ...	50*s.* ,,
800 to £900 ...	60*s.* ,,
1,000 to £1,200 ...	70*s.* ,,
Above £1,200 ...	5*s.* per cent.

Churches and public buildings by meter.

Lambeth.—Same as Southwark and Vauxhall. Charge for connection, including stop-cock, ferrule, opening ordinary ground, and reinstating, constant-supply district only, ½ in., is 15*s.*

An analysis of the cost of a building supply from a London company (say the Grand Junction) for a job to cost £1,000 would therefore be :—

Analysis.	£	s.	d.
Cost of water, 6*s.* per cent. on £1,000	3	0	0
Company's charges for opening ground and providing ferrule	0	10	0
Use and waste only of, say, 30 ft. run of ¾-in. lead pipe at 4*d.* per foot	0	10	0
Ditto of ball-cock	0	1	0
Soldering joint of ¾-in. lead pipe and ball-cock	0	1	6
	4	2	6
Add 15 per cent. profit on first two items	0	10	6
Total ...	£4	13	0

The piping, &c., used is only for temporary purposes, and will, therefore, revert to the contractor, who merely charges for use and waste.

Water for a Provincial Job.

When the work is in the country London rates will not apply, and the cost of water will be computed according to the local charge of perhaps 6*d.* to 1*s.* per 1,000 gals. As water is mainly used for concrete, wetting bricks, mortar, plastering, limewhiting, &c., the total number of gallons may be reckoned thus :—

Allow roundly 25 gals., gross, per yd. cube of concrete.
,, ,, 550 ,, ,, ,, rod of brickwork.
,, ,, 50 ,, ,, ,, yd. cube of mortar.
,, ,, 3 ,, ,, ,, yd. super. of plastering, 3 cts.
,, ,, ¼ ,, ,, ,, yd. super. of limewhiting, 2 cts.

Supposing the amounts of foregoing work, taken from the quantities, to be 100 yds. cube of concrete, 20 rods of brickwork, 40 yds. cube of mortar, 200 yds. super. of plastering, and 60 yds. super. of limewhiting, then a rough calculation would appear :—

	Gals.
100 yds. cube concrete × 25 gals.	2,500
20 rods brickwork × 550 gals.	11,000
40 yds. cube mortar × 50 gals.	2,000
200 yds. super. plastering × 3 gals.	600
60 yds. super. limewhiting × ¼ gal.	15
	16,115
Add 25 per cent. for other uses and waste, say ...	4,085
Total water required	20,200

	£	s.	d.
Therefore, 20,200 gals. × 1s. per 1,000 gals. (local charge) ...	1	0	0
Add for connection with main, opening ground and reinstating, erection of stand pipes, fixing taps, &c., maintaining same and removal, and making good on completion of work, say	0	15	0
Use and waste only of, say, 30 ft. run of $\frac{3}{4}$ in. lead pipe, at 4*d*. per ft.	0	10	0
	2	5	0
Add 15 per cent. profit on first two items	0	5	0
Total cost for job...	£3	0	0

Fire Insurance.

"Allow for insurance from fire to the amount of tender, and deposit the policy with the architect."

It appears to be more customary to have buildings insured during erection in London than in provincial towns, where they are generally not insured at all. In the former, it is unusual to insure before the roof is on, or until some combustible material is fixed; and then it is frequently stated for only two-thirds the amount of contract. A reasonable scale may be taken as below, to which the contractor may add 15 per cent. profit.

Value.	Three Months.	Six Months.	Nine Months.	Twelve Months.
For each £100 assured...	1s. 3*d*.	1s. 9*d*.	2s. 0*d*.	2s. 6*d*.

Notices to Authorities.

"Allow for giving all notices to the local authorities, and for supplying any drawings or information required by them, and pay all fees."

Copies of local building by-laws and regulations can be obtained on application at the borough surveyor's office, where tracings by the architect of the plans, showing drains, &c., have to be deposited in time to be laid before the council or building committee for approval.

In so vast an area as the Metropolis, the London Building Act of 1894 specially controls the erection of all buildings, which are subject to the supervision of the district surveyor appointed to the district in which the structure or building is situated. Of these there are fifty-eight, and by par. 145,

Part XIII., the notices to be given to the surveyor by the builder are—

"145. In the following cases and at the following times, that is to say:—

(*a*) Where a building or structure or work is about to be begun, then two clear days before it is begun; and

(*b*) Where a building or structure or work is, after the commencement thereof, suspended for any period exceeding three months, then two clear days before it is resumed; and

(*c*) Where, during the progress of a building or structure or work, the builder employed thereon is changed, then two clear days before a new builder enters upon the continuance thereof;

the builder (or other person causing or directing the work to be executed) shall serve on the district surveyor a building notice respecting the building, or structure, or work. Every building notice shall state the situation, area, height, number of stories, and intended use of the building, or structure, and the number of buildings, or structures, if more than one, and the particulars of the proposed work, and the name and address of the person giving the notice (and those of the owner then in possession of, and the occupier of the building or structure, or of its site or intended site). All works in progress at the same time to, in, or on the same building or structure may be included in one building notice."

Fees to District Surveyors.

The following are the fees payable to district surveyors under the Third Schedule of the above Act:—

ON NEW BUILDINGS.	£	s.	d.
"For any building not exceeding 30 sq. ft. in area and not exceeding 10 ft. in height	0	10	0
For every building not exceeding 400 sq. ft. in area and not more than two stories in height	1	10	0
For every additional story	0	5	0
For every additional square of 100 ft. or fraction of a square	0	2	6
For every building not exceeding 400 sq. ft. in area and of one story only in height	0	15	0
ON ADDITIONS, ALTERATIONS, OR OTHER WORKS.			
"For every addition or alteration, or other work to which the provisions of this Act apply, made or done to or on any building after the roof has been covered in		—	
One-half of the fee charged in the case of a new building, calculated upon the area of the whole building		—	
For inspecting the arches or fire-resisting floors over or under public ways	0	10	0
For inspecting the formation of openings in party-walls (for each opening)	0	10	0
For inspecting the closing of openings in party-walls (for each opening)	0	10	0

"Provided that in the case of public buildings, buildings constructed of concrete, and buildings divided into separate sets of chambers or

tenements by party structures, the fees before specified shall in every case be increased by one-half."

There are also fees for chimney shafts and flues, for certifying plans, and for attending at Court when an order is made on the builder for complying with the notice of irregularity. The fees required for inspection of any wooden or temporary structure are the same as for a new building.

In addition to the foregoing, by the by-laws of the London County Council, there is a fee to the district surveyor of 5*s.* on any new house or building, in respect of the duties imposed upon him by the Metropolitan Management and Building Acts Amendment Act, 1878 (relating to protection from fire of theatres and other places of public resort), and these by-laws, such fees to be payable in the manner and at the time prescribed by section 51 of the Metropolitan Building Act, 1855. Also an additional fee of 5*s.* for artisans' schemes, under the London County Council (General Powers) Act of 1890.

By the same Acts it is necessary to conform to the regulations of the various Metropolitan borough councils, district boards, and parishes, chiefly as regards sanitary measures and connections to drains and sewers, &c., and plans must be sent in of the proposed systems. The rules and charges are best obtained on application; but those of St. George's, Hanover Square, may be quoted as being fair and reasonable:—

The parish connects drain with sewer, inserting flap-trap and two lengths of pipe at the following rate:—

	£	*s.*	*d.*
6 in.	0	15	0
9 in.	0	19	0
12 in.	1	6	0

The builder digs and fills in.

Watching and Lighting.

"Allow for any necessary watching and lighting."

It is frequently desirable to keep on the premises a day watchman during non-working hours, and a night watchman, to prevent theft of material. The pay of such is 6½*d.* per hour, plus ½*d.* per hour for use of lamp, including oil and wick, and his total period of watching can easily be calculated from the length of time put down for the completion of the building.

If it is found necessary to perform work of any description by artificial light, the contractor is allowed the cost of

the *light only* in addition to the contract rates. The "Wells light" and the "Lucigen light," which generate oil into vapour and burn it in large powerful flames, are the artificial lights best adapted for contractors' and general outdoor purposes, as they are portable and self-contained.

Clerk of Works.

"Allow for an office for clerk of works and the requisite firing, light, and attendance, and for all sheds, &c., required for materials."

Contractors either erect a temporary wooden office on the site for the clerk of works or else have a small portable structure, which can be taken about from their yard to the job. The former would be knocked together from any old pieces of boarding, and might cost £10; while if the latter were constructed of galvanised iron, and consisted of one room about 8 ft. by 8 ft., it would come to about £15 when purchased new. A small stove or fireplace would be required in the winter months, for which allow 6*d.* per day for fuel.

For an office for clerk of works, of wood, 12 ft. × 12 ft. × 8 ft. to collar, with boarded floor, window, desk, lock-up drawers, stove, &c., removal at completion of job, and supplying light and coal during contract (18 months), a builder's actual price in his quantities was £30.

One or two rough wooden sheds may be necessary in which to store cement, timber, and other materials from the weather, or to provide shelter for the masons when cutting out stone. The number and size of these would entirely depend upon the kind of job.

Make Good all Defects.

"Allow for keeping the works in proper repair for six months after completion, and for making good all defects or damages that may arise during that period and during the progress of the work, including injury by frost, &c."

A careful builder will avoid risks in this connection by attention and foresight, and by seeing that all workmanship and details are properly carried out; otherwise the sum put down for this item will have to be higher than need be. The amount will be more or less speculative, but a valuation of £5 per £1,000 of work is not out of place.

Attendance on each Trade.

"Allow for each trade to attend on all others, and do all jobbing work required."

Such a clause affects builders more in the North than in other parts of the kingdom, where the system of separate contracts for each tradesman obtains. Each tradesman has to attend and make good the work of others, as when a bricklayer has to pin in the end of a beam with cement, or a mason cut a hole in a wall for a gaspipe and make good. The charge for this item is very uncertain, and increases from £5 upwards. £1 per £1,000 of work is a rough sort of guide; but £5 is generally the lowest, and the rise not proportionate to the amount of contract.

Clear Away Rubbish, &c.

"Allow for clearing away all dirt or rubbish and superfluous materials, and for washing all floors, cleaning windows, and leaving the premises clean on completion, and for levelling up round the building."

The cost of this is likewise speculative, and would be pretty much the same as last item, being based accordingly. Allow, say, from £2 upwards.

Scaffolding.

"Allow for all scaffolding, profiles, rods, &c., and stakes and labour in setting out works."

Though these come under the heading of Builders' Plant, scaffolding is more conveniently dealt with as a separate item in the cost of brickwork, and may be put down at 6*s.* per rod—erection and use only, not as new.

If scaffolding and other plant have to be hired, then the charges on following page would have to be reckoned, which include delivery and depositing in position where directed, removal, wear, tear, and repairs.

Lamps, use of, for night watchman, including oil and wick	each ½*d.*	per hour.
Horse, with proper harness, in good working condition	„ 8*d.*	„
Cart, two-wheel, water cart	„ 2*d.*	„
Waggon, four-wheel, or timber carriage	„ 3*d.*	„

When the hiring is for more than one week, the price for the first week is allowed, and the remaining time at a

HIRE OF PLANT.

Description.		First Week. Day.	First Week. Week.	Second Week. Day.	Second Week. Week.	Third Week. Day.	Third Week. Week.	After Third Week. Day.	After Third Week. Week.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Barrows, wheel	each	0 5	2 0	0 3½	1 4	0 1½	0 8	0 1	0 4
Blocks and fall, of size ordered	per set	1 0	5 0	0 8	3 4	0 4	1 8	0 2	0 10
Blocks, pulley, differential, with chain	,,	2 0	10 0	1 4	6 8	0 8	3 4	0 4	1 8
Boards, scaffold	per doz.	0 2½	1 0	0 1¾	0 8	0 1	0 4	0 0½	0 2
Cords, scaffold	,,	0 2½	1 0	0 1¾	0 8	0 1	0 4	0 0½	0 2
Crab, double purchase, complete	each	3 0	15 0	2 0	10 0	1 0	5 0	0 6	2 6
Cramps, floor	,,	1 0	5 0	0 10	4 0	0 8	2 6	0 4	1 0
Engine, portable, for pumping or other purposes, not exceeding 6 H.-P., including coals and attendance	,,	30 0	150 0	28 6	142 6	27 0	135 0	25 0	125 0
Engine, ringing, or crab pile, including rings for heads and every necessary article for driving piles	,,	5 0	25 0	3 4	17 0	1 8	8 0	0 10	4 0
Jacks, screw, to lift 6 tons	,,	0 7	3 0	0 5	2 0	0 3	1 0	0 1	0 6
Ladders, 20 rounds	,,	0 5	2 0	0 3	1 4	0 1½	0 8	0 0¾	0 4
,, 40 ,,	,,	1 0	5 0	0 8	3 4	0 4	1 8	0 2	0 10
,, 60 ,,	,,	1 3	6 0	0 10	4 0	0 5	2 0	0 2	1 0
Mill, mortar, with pan 5 ft. diam., &c.	,,	10 0	50 0	6 8	33 0	3 4	17 0	1 8	8 0
Planks, wheeling	per doz.	0 6	2 6	0 4	1 8	0 2	0 10	0 1	0 5
Poles, scaffold, under 22 ft. long	,,	0 5	2 0	0 3¼	1 4	0 1½	0 8	0 1	0 4
,, ,, over 22 ft. long	,,	0 9	3 9	0 6	2 6	0 3	1 2	0 1½	0 7
Pumps, W.I., contractor's, 4 in. to 6 in. diam.	each	1 0	5 0	0 9	4 0	0 7	3 0	0 5	2 0
Putlogs	per doz.	0 2½	1 0	0 1¾	0 8	0 1	0 4	0 0½	0 2
Screens	each	0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Sieves	,,	0 2	0 10	0 1½	0 7	0 1	0 4	0 0½	0 2
Tarpaulins	,,	1 0	3 0	0 6	2 6	0 6	2 0	0 3	1 0
Trestles for two boards on top, 6 ft. high	,,	0 6	2 6	0 4	1 8	0 2	0 10	0 1	0 5
,, ,, ,, 9 ft. ,,	,,	0 7	3 0	0 5	2 0	0 3	1 0	0 1	0 6
Waggon, four wheel	,,	3 0	15 0	2 0	10 0	1 0	5 0	0 6	2 6
Waggon or cart, two wheel	,,	2 0	10 0	1 4	6 8	0 8	3 4	0 4	1 8
Wedges, scaffold	per doz.	0 2½	1 0	0 1½	0 8	0 1	0 4	0 0½	0 2
Wheel and rope	each	0 9	4 0	0 6	2 8	0 3	1 4	0 1½	0 8
Wheels or pulleys, 12 in., contractor's rubbish, with frames complete, and 150 ft. of rope	,,	0 6	2 6	0 4	1 8	0 2	0 10	0 1	0 5
Winch (builders'), with two wheels, and baskets and rope	,,	4 0	20 0	2 8	13 4	1 4	6 8	0 8	3 4

proportionate rate of the above table. Fractions of a day to be reckoned as a whole day.

Most contractors, however, do not rely upon hiring, except for special purposes, but usually possess their own plant, the list prices (exclusive of discount or profit) of some common articles being as follows :—

Purchase of Plant.

		£	*s.*	*d.*
Barrows, excavators', stout ash, with cleats, and well bolted	each	0	17	0
Brick crushers, the "Clapton," No. 1, with two fly wheels	,,	17	10	0
,, ,, ,, No. 2, ,, ,,	,,	22	10	0
,, the "Croydon," No. 1, to break 5 tons per hour	,,	45	0	0
,, ,, No. 2, ,, 10 ,, ,,	,,	60	0	0
Buckets or pails, galvanised iron, riveted, 12 in. diam.	,,	0	2	9
Crabs, double purchase, with strap-brake, to lift 5 tons	,,	5	10	0
Cramps, joiner's, W.I. bench, 6 ft. long...	,,	1	0	0
Crane, hand derrick, to lift 5 tons, 45 ft. jib, 21 ft. upright	,,	80	0	0
Engine and boiler, ordinary portable, on wheels, 6 H.-P.	,,	180	0	0
Jacks, screw, to lift 6 tons, 2¼ in. diam. screw, with iron case	,,	4	0	0
Ladders, 12 rounds and under	per round	0	0	5
,, 13 ,, not exceeding 30 ...	,,	0	0	6
,, 31 ,, ,, ,, 45 ...	,,	0	0	7
,, 46 ,, ,, ,, 55 ...	,,	0	0	8
,, 56 ,, ,, ,, 60 ...	,,	0	0	8½
,, 61 ,, ,, ,, 65 ...	,,	0	0	9½
,, 66 ,, ,, ,, 75 ...	,,	0	0	11
,, 76 ,, ,, ,, 85 ...	,,	0	1	5
,, 86 ,, ,, ,, 100 ...	,,	0	2	6
,, painting three coats plain colour, extra	,,	0	0	1½
,, iron bolts to, extra	each	0	0	6
Lewises, chain, from	,,	0	4	6
,, stone, ,, ...	,,	0	7	6
Mills, mortar, 5 ft. diam. pan, on wheels	,,	52	0	0
Mortising, boring, and tenoning machine, complete ...	,,	12	0	0
Picks and pickaxes	per cwt.	1	13	0
Handles for ditto	each	0	0	9
Pulleys, heavy pattern, W.I. pulley blocks, 6 in. diam. sheave, snatch	,,	1	0	0
Ditto, 6 in. ditto, 1 sheave	,,	1	0	0
Ditto, 6 in. ditto, 2 sheaves	,,	1	6	0
Ditto, 6 in. ditto, 3 sheaves	,,	1	12	0
Pulleys, Weston's differential pulley block, with guides, tested to 1 ton	,,	0	17	6
Pump, W.I. galv. contractor's, 4 in. diam. suction-pipe, 7 ft. long	,,	2	10	0
Ditto, 6 in. ditto	,,	3	2	0
Putlogs, hewn birch, 6 ft. long by 3½ in. by 3 in. ...	,,	0	0	9½
Rammers, earth	,,	0	4	0
Rope, tarred, of any size required	per cwt.	3	5	0
,, white, European, of any size required ...	,,	3	10	0

Purchase of Plant—*continued*.

		£	s.	d.
Scaffold boards, iron bound, 12 ft. long	per doz.	1	2	0
,, birch putlogs, best	,,	0	7	6
,, cords	,,	0	7	0
,, poles, 22 ft. long	each	0	1	6
,, ,, 28 ft. ,, ...	,,	0	2	9
,, ,, 35 ft. ,, ...	,,	0	5	0
,, ,, 42 ft. ,, ...	,,	0	7	0
Screens, builder's, for sand, gravel, &c., 6 ft. high, ¼ in. mesh	,,	1	5	0
Shovels, helved, universal, common	,,	0	2	0
Sieves, sand, fine, iron wire, 18 in. diam.	,,	0	3	6
Spades, helved, common	,,	0	2	6
Tarpaulins	per sq. yard	0	2	0
Trestles, 6 ft. high	each	0	16	0
,, 9 ft. ,, ...	,,	1	2	0
Trowels, bricklayer's, 12 in.	,,	0	2	6
"Wells Light," No. 1 (Hand pattern), 1,500 candle-power, complete	,,	10	0	0
Wheels or pulleys, rubbish, 12 in. diam., for 1-in. rope	,,	0	12	0

Builders wishing to buy or dispose of spare plant would do well to consult the "Contractor's Monthly Register" issued by Lewis and Lewis, engineers, London, wherein second-hand machinery and plant of all kinds are advertised for sale or hire. Insertions are free; but a commission is charged if a purchaser is found thereby. The "Tool and Machinery Register," published monthly by the Britannia Co., Colchester, and Phillips' "Monthly Machinery Register," Newport, Mon., fulfil a similar purpose.

Scaffolds.

The Court of Common Council, under the City Corporation, have regulations and fees for scaffolds (as well as for hoards, raising shores, &c.) within the City of London, and issue licenses. These duties were formerly discharged by the Commissioners of Sewers. No scaffold or hoard is to project beyond the footway pavement where it is narrow, nor more than 6 ft. where it is wide enough to admit of such projection. Each stage to have fan and edge boards, and other such precautions to prevent dirt or wet falling upon the public. The following are the

FEES FOR LICENSES FOR SCAFFOLDS.

		s.	d.
If to remain not more than 2 weeks, per foot lineal of frontage...		0	4
If over 2 weeks and not more than 4 weeks...	per foot lineal	1	0
,, 4 ,, ,, ,, 8 ,, ...	,, ,,	3	0
,, 8 ,, ,, ,, 12 ,, ...	,, ,,	6	0
,, 12 ,, ,, ,, 16 ,, ...	,, ,,	10	0
,, 16 weeks, for every month or part of a month	,, ,,	5	0

No fee to be more than £10 without the right to advertise.

Hoardings.

"Allow for erecting, maintaining, and altering as may be required, a proper hoarding for the protection of works, with all necessary gates, fastenings, &c., to the satisfaction of the local authorities, length of frontage being — ft., with two returns."

The regulations of the Court of Common Council state that hoards within the City of London must not have doors opening outwards to interrupt foot-passengers, and that where needed a boarded platform 4 ft. wide, and as much wider as may be necessary for the traffic, with stout posts, rails, and wheel kerbs on the outside of it, are to be constructed outside the hoard, as may be directed. The license for hoarding rises to over 5*s*. per foot run per month; but an average charge is 2*s*. 6*d*. per month. About 50*s*., say, for every £1,000 of work is a rough estimate. That below is the proper scale:—

FEES FOR LICENSES FOR HOARDS.

		s.	*d*.
If to remain not more than 2 weeks, per foot lineal of frontage...		0	6
If over 2 weeks and not more than 4 weeks...	per foot lineal	1	6
,, 4 ,, ,, ,, 8 ,, ...	,, ,,	4	6
,, 8 ,, ,, ,, 12 ,, ...	,, ,,	9	0
,, 12 weeks, for every month or part of a month	,, ,,	5	0

No fee to be more than £10 without the right to advertise.

In addition to the above scale of fees, the following payments have to be made for the right to advertise:—10*s*. per 100 ft. super. per month in first-class streets, and 5*s*. ditto in all other streets. If the hoarding is in a good position, a considerable profit may be made on the advertising.

Hoardings are generally made up of any old timber the contractor may have on his hands, and the price is, therefore, for the use and waste only of this old stuff, including cartage to site, fixing, and removal. A hoard of the usual height of 7 ft. is worth 1*s*. 3*d*. per foot run, plus 6*d*. per foot run for the fan over, plus 1*s*. 3*d*. per foot run for a 4 ft. wide planked footway and rail fence—or, say, 3*s*. per foot run complete for the three items added together. Speculative contractors put down 10*s*. to 12*s*. per square for the boarding only. This includes wear and tear and profit. A more precise method of estimating this item is to take out quantities of all the stuff, and price for use and waste only, as before stated.

FEES FOR LICENSES FOR RAKING SHORES.

		£	s.	d.
If to remain not more than 2 weeks	each	0	5	0
If over 2 weeks and not more than 4 weeks	,,	0	15	0
,, 4 ,, ,, ,, 8 ,, ...	,,	2	0	0
,, 8 ,, ,, ,, 12 ,, ...	,,	4	0	0
,, 12 weeks, for every month or part of a month ...	,,	2	0	0

The use and waste of shoring may be priced at 1*s.* 3*d.* per foot cube, including labour, wedges, spikes, hoop-iron, removal, and profit.

Provisions.

"Provide the following sums to be expended as directed, or to be deducted in full if not required. If contractor desires a profit, he must add it to the amount named in each case, and he must allow for packing, carriage, and fixing. P. C., or net cost, shall mean the net cost after deducting from the merchant's list price the trade discount; but not the discount for cash."

> "Provide the sum of £500 for carving.
> Provide the sum of £170 for chimneypieces.
> Provide the sum of £35 for stained-glass window.
> Provide the sum of £200 for counters and fittings."

The above cases are only typical ones, and provisional amounts may be inserted for anything. The object of thus stipulating that the contractor shall provide a certain sum of money in his tender for a particular purpose is to avoid anything inferior being introduced, as would probably be the case if the selection and cost were left to him to do as he pleased. Without this precaution there is a temptation to evade the letter and spirit of the provision, to get a price quoted that will enable the contractor to make an extra profit out of the transaction. On the adjustment of these sums there is much misunderstanding, unless there is a clear definition as to prime cost, inclusion or exclusion of profit, deduction of sum if article is not required, error in extending the provisional amount in the money column of the priced bill of quantities, &c. The best way to guard against any future difficulty is to carefully word the clause relating to these provisions in some such manner as described at the beginning of this item. The definition of "prime cost," in particular, is frequently loosely specified, or even omitted altogether, leading to a dispute between the architect and builder as to whether P. C. means *list* prices or net cost after deducting the trade discount from these list prices.

Mr. Thomas S. Jerome, F.S.I., Chief Surveyor, War Department, stated in the *Building News* of October 8th, 1897, that "A provisional sum in a bill of quantities should always be considered a fixed one, entirely under the control of the architect or surveyor, no matter how it has been treated by the contractor. If he ignores it (and probably obtains a contract by so doing), is the client to have the cost of his building increased, if the provisional work be executed, or suffer by it not being done, through a contractor's negligence or wilfulness? If a provisional sum be magnified, it militates against the tender being the lowest; if it became a rule to deal with the 'extended' sum (if it differs from the provisional amount), difficulties must arise. Having stipulated that a contractor shall provide a certain sum of money in his tender for something (seen or unforeseen) to be done, nothing more, nor less, should be considered when squaring up the contract; whether he increases, reduces, or omits it, is entirely his affair. In the quantities for the erection of a large public institution, in a suburb of London, the provisional sum of £2,000 was inserted for carving. The contractor omitted to 'extend' it; nevertheless the carving was executed, and no extra was allowed."

CHAPTER V.—EXCAVATOR.

MEMORANDA.

THE following memoranda will be found indispensable:—

CAPACITY OF CARTS, &C.

An ordinary one-horse cart, 6 ft. long by $3\frac{1}{4}$ ft. wide by $2\frac{1}{3}$ ft. deep, will hold 45 cubic feet, or	$1\frac{2}{3}$ cubic yards.
A builder's cart will hold of earth, sand, rubbish, &c.	1 ,, ,,
A tumbrel, or tipping cart	$1\frac{1}{4}$,, ,,
A dobbin, or three-wheel cart	$\frac{3}{4}$,, ,,
An earth or tip waggon, large, heaped	3 ,, ,,
,, ,, ,, filled to level of sides ...	$2\frac{3}{4}$,, ,,
An earth or tip waggon, small, heaped	$2\frac{1}{2}$,, ,,
,, ,, ,, filled to level of sides...	2 ,, ,,
A wheelbarrow, navvy's (large), will hold 50 bricks, or	$\frac{1}{10}$,, ,,
,, ,, ordinary	$\frac{1}{14}$,, ,,
,, ,, light	$\frac{1}{18}$,, ,,
A basket holds 1 bushel, or	$\frac{1}{21}$,, ,,
The average earth waggon holds...	50 barrow loads.
A stone truck, or waggon, holds	3 to 10 tons.
A railway truck, or waggon (16 ft. long by $7\frac{1}{2}$ ft. wide by 3 ft. high)	8 ,, 10 ,,
A Thames lighter	90 ,, 120 ,,

A double load = generally speaking, 2 cubic yards of 54 cubic feet, or 42 striked bushels.

A single load = generally speaking, 1 cubic yard of 27 cubic feet, or 21 striked bushels.

,, ,, = generally speaking, 1 cubic yard of earth, rubbish, sand, mortar, &c.

,, ,, = generally speaking, 1 ton weight of iron, lead, stone, &c.

,, ,, = a "hundred" of lime (100 pecks or 25 bushels) = 1 cubic yard heaped up.

,, ,, = 500 ordinary bricks.

,, ,, = 400 glazed bricks.

,, ,, = 1,000 plain tiles.

,, ,, = 1,000 Countess slates.

,, ,, = 12 squares of flooring.

,, ,, = 50 cubic feet of squared timber.

,, ,, = 40 ,, ,, unhewn timber.

,, ,, = 80 ,, ,, light bulky articles.

,, ,, = 1 butt of water of 224 gallons.

,, ,, = 30 cwt. of mortar (1 cubic yard).

Weight of Earth, Rocks, &c. :—

		Cwt.			Cwt.
1 c. yd. of	common earth weighs	24	1 c. yd. of	chalk ... ... weighs	35
,,	top soil ... ,,	20	,,	sandstone ... ,,	38
,,	clay ... ... ,,	27	,,	limestone ... ,,	40
,,	mud ... ... ,,	25	,,	shale ... ... ,,	40
,,	dry sand ... ,,	22	,,	quartz ... ,,	41
,,	wet sand ... ,,	30	,,	granite ... ,,	42
,,	sandy loam ... ,,	24	,,	trap ... ... ,,	42
,,	gravel ... ,,	30	,,	slate ... ... ,,	43
,,	loam ... ... ,,	24	,,	peat, dry ... ,,	8
,,	marl ... ... ,,	26	,,	peat, wet ... ,,	15

And :—

		Ton.			Ton.
24 c. ft. of	earth ... ... weigh	1	21 c. ft. of	loam ... ... weigh	1
32 ,,	earth mould ... ,,	1	19 ,,	gravel ... ... ,,	1
18 ,,	clay ... ... ,,	1	24 ,,	shingle ... ,,	1
19 ,,	marl ... ... ,,	1	22 ,,	Thames ballast ,,	1
20 ,,	river sand ... ,,	1	15 ,,	chalk ... ... ,,	1
21 ,,	pit sand ... ,,	1	29 ,,	chalk in lumps ,,	1

For sowing grass seed allow 2 bushels per acre.

Proportion of Increase in Bulk of Earth, &c., when excavated and thrown into a loose heap :—

	Before Digging.	When Dug.
Earth and clay	1 ...	... $1\frac{1}{4}$
Sand and gravel	1 ...	... $1\frac{1}{12}$
Road metal	1 ...	... $1\frac{1}{5}$
Chalk, depending on size of pieces ...	1 ...	... $1\frac{1}{3}$
Rock, ,, ,, ...	1 ...	... $1\frac{1}{2}$

Conversely, excavated material will settle down and eventually shrink to its original bulk before digging. A usual allowance for settlement is 1 in. for every foot of height, but sometimes as great as 3 in.

Natural Slopes of Earth from the Horizontal :—

	Angle of Repose.		Angle of Repose.
Clay, dry	45°	Earth, vegetable	34°
Clay, wet	15°	Gravel	40°
Earth, compact	50°	Sand, fine dry	32°
Earth, loamy	40°	Sand, ordinary	22°
Earth, loose	30°	Shingle	36°

Proportion of Excavators, Shovellers, and Wheelers (up to 2 runs :—

Description of Soil.	Excavators or Getters.	Shovellers or Fillers.	Wheelers or Removers.
Loose sand and vegetable mould	1	2	2
Compact earth	1	1	1
Hard clay	2	1	1
Rock	3	1	1

The rate at which a cutting may be expected to advance will be, for each line of wheelers or for each shoveller, in one rank :—

20 yards cube of loose sand or mould per day.
16 yards cube of compact earth or clay per day.

Labour in Digging, &c.

An excavator can dig and throw out per day of ten hours:—

Over areas,	soft ground for agricultural purposes, 8 in. to 10 in. deep	yds. super.	220
,,	common soil not exceeding 12 in. deep	,,	20 to 22
,,	loamy clay	yds. cube	16
,,	made ground or light soil	,,	13 to 15
,,	common ground	,,	8 to 10
,,	stiff clay or gravel	,,	5 to 7
,,	hard ground where picking is required	,,	3 to 5
,,	chalk	,,	5
,,	hard rock requiring blasting	,,	2
In trenches,	made ground	,,	12
,,	common ground	,,	8
,,	clay or gravel	,,	5 or 6
,,	chalk	,,	3
,,	hard rock requiring blasting	,,	1
,,	throwing out beyond one throw in made ground	,,	30
,,	throwing out beyond one throw in common ground	,,	22
,,	throwing out beyond one throw in clay or gravel	,,	17
Return and fill in common soil, without ramming...		,,	18 to 22
Ramming ditto in foundations		,,	18 to 22
Working or tempering puddle clay		,,	4
Removing not exceeding 50 yards and depositing, including filling barrows		,,	35
Filling carts, common soil		,,	20 to 22
Levelling common soil from heaps without throwing		,,	60

49 yards super. = 1 rood of surface digging in the country.

PRICES.

The following prices include labour, material, profiles, rods, profit, &c.:—

Excavating, &c.

Description.		Made Ground.	Common Ground.	Stiff Clay, Gravel, or Loose Chalk.
		s. d.	s. d.	s. d.
Dig, throw out, and form surfaces not exceeding 12 in. deep	per y.s.	0 3½	0 4	0 5
Digging and throwing out over areas exceeding 12 in. deep, including levelling	per y.c.	0 7	0 9½	1 0
Ditto in trenches, including levelling bottom, and fixing and removing shoring and close planking where required, not exceeding 6 ft. deep...	,,	0 10	1 0	1 2

EXCAVATING, &c.—*continued.*

Description.		Made Ground.	Common Ground.	Stiff Clay, Gravel, or Loose Chalk.
		s. d.	s. d.	s. d.
Add for each additional 6 ft. in depth, the first 6 ft. being paid for under last item	per y.c.	0 3	0 4½	0 6
Add to last if in shafts, tanks, or cess-pits	,,	0 1½	0 1¾	0 2
Spreading and levelling in layers not exceeding 12 in. deep	,,	0 1	0 1½	0 2
Add to last for well ramming	,,	0 1½	0 2	0 3
Return, fill in any depth, including spreading, levelling, and well ramming, but exclusive of wheeling or carting (the cubical contents of cavity filled in being measured)	,,	0 6	0 7	0 8
Supplying only, soil for filling under floors, &c.	,,	1 3	1 6	2 0
Labour and water only in forming puddle walls, filling to coffer dams, lining reservoirs, &c., with clay well worked and rammed in 6 in. layers...	,,	—	—	2 0
Clay, clean yellow, for foregoing puddle	,,	—	—	7 6
Roughly trimming surfaces of excavation if required, cutting not exceeding 3 in. thick	per 100 f.s.	0 6	0 7	0 9
Digging for post holes under ¼ yd. cube, including filling in and ramming ...	each	0 5	0 6	0 8

		s. d.
First use and waste of timber strutting to sides of excavation, including struts, walings, &c., fixing and removal	per f.c.	1 0
Ditto, in planking of required thickness, behind walings	per f.s.	0 1
(For subsequent use take one-third of above rates each time.)		
Handpacking, any thickness, with rubble, stones, &c., behind walls, including wheeling under 50 yds. ...	per y.c.	0 10

REMOVING.

Description.		Made Ground.	Common Ground.	Stiff Clay, Gravel, or Loose Chalk.
		s. d.	s. d.	s. d.
Removing not exceeding 50 yds., and depositing at a level not exceeding 5 ft. above starting-point	per y.c.	0 3½	0 4	0 4½
Add for each 25 yds. up to 100 yds. from starting-point	,,	0 1	0 1	0 1½

REMOVING—*continued.*

Description.	Made Ground.	Common Ground.	Stiff Clay, Gravel, or Loose Chalk.
	s. *d.*	*s.* *d.*	*s.* *d.*
Removing over 100 yds. and not exceeding 1 furlong, and depositing ... per y.c.	0 9	0 11	1 1
Add for every furlong in addition ... ,,	0 1	0 1	0 1½
Raising only, for every additional 5 ft. above the first 5 ft. level ... ... ,,	0 1½	0 2	0 2½
Basketing earth or rubbish of any kind, as from the inside to the outside of a building, any floor ... ... ,,	0 4	0 4	0 6
Carting rubbish and finding a shoot, not exceeding 1 mile ... ... per load or y.c.	3 0	3 0	3 6
Ditto, for every additional mile ,, ,,	1 0	1 0	1 0

		s. *d.*
Horse, cart, and driver...	per day	12 6
Two horses, cart, and driver	,,	17 6
Loading or unloading barges or boats placed alongside, the material being delivered within 10 yds. of side of barge	per ton or load	0 7
Removing by barges or boats at a distance of 1 mile or under ... ... ,,	,,	1 6
Add for every additional mile, or part of a mile, beyond the first ... ... ,,	,,	0 6

TURFING.

Garden mould, supplied only, to spot required ...	per y.c.	5 6
Covering with vegetable earth in layers not exceeding 6 in. deep	per y.s.	0 3
Cutting or taking up grass sods any reasonable size, and rolling and stacking for use	per 100 f.s.	1 3
Grass sods, 24 in. × 12 in. × 3 in., supplied only and delivered	,,	5 0
Laying sods, and twice beating, labour only ...	,,	2 0
Rolling grass surfaces, with horse roller	,,	0 0½
,, ,, ,, with hand roller	,,	0 1
Grass pasture seeds, supplied only	per bushel	18 0
Labour only, sowing ditto	per acre	3 6

SINKING WELLS AND BORING.

Description.	Earth, Clay, or Gravel.	Solid Chalk, &c.
	s. *d.*	*s.* *d.*
Sinking for wells of any diameter, including all timbering, tackle, &c., keeping out water, and moving the stuff to any distance not exceeding 50 yds., for any depth not exceeding 20 ft. ...per y.c.	4 0	5 0

SINKING WELLS AND BORING—*continued.*

Description.	Earth, Clay, or Gravel.		Solid Chalk, &c.	
	s.	*d.*	*s.*	*d.*
Ditto, exceeding 20 and not exceeding 40 ft. deep per y.c.	5	0	6	0
,, ,, 40 ,, ,, 60 ,, ,,	6	3	7	3
,, ,, 60 ,, ,, 80 ,, ,,	7	6	8	6
,, ,, 80 ,, ,, 100 ,, ,,	8	9	9	9
BORING.	Boring only.			
	4 in.		6 in.	
Boring for water, &c., through earth, clay, or gravel (including removing the stuff, not exceeding 50 yds.), for any depth not exceeding 20 ft....per ft. run	4	6	5	3
Ditto, exceeding 20 and not exceeding 40 ft. deep ,,	5	0	5	9
,, ,, 40 ,, ,, 60 ,, ,,	5	9	6	6
,, ,, 60 ,, ,, 80 ,, ,,	7	9	8	9
,, ,, 80 ,, ,, 100 ,, ,,	8	6	9	6

		s.	*d.*
Wages, excavator...	per hour	0	7½
,, ganger	,,	0	8
,, carter or driver	,,	0	6½
,, general labourer...	,,	0	6½
,, watchman, day or night	,,	0	6½

ANALYSIS.

EXCAVATING, &C.: LABOUR OF EARTHWORK.

The operations comprised in earthwork usually are :—

1. Getting, or excavating.
2. Filling into barrows, carts, or waggons.
3. Removing—*i.e.*, wheeling in barrows, or leading in waggons.
4. Tipping, or teaming—*i.e.*, finally depositing.
5. Spreading, after depositing.

Ground to be excavated may in general terms be classed as follows :—

1. Loose earth, made ground, sand, or mud, that can be lifted with a shovel without digging.

2. Common ground, where nothing more is necessary beyond cutting with a spade, an operation called "cutting."

3. Stiff earth, clay, gravelly soil, or loose chalk, that require getting by means of a pickaxe, an operation called "hacking."

4. Rock and other hard ground, which requires to be blasted.

Most earths require cutting and hacking, and some need all the above operations. One excavator to 5 ft. or 6 ft. breadth of face of a cutting is as near as they should be for efficient working.

Excavator's wages have been taken at $7\frac{1}{2}d.$ per hour, but digging is usually done by common labourers at $6\frac{1}{2}d.$ per hour, or even less, in which case a saving would be effected in the following prices. For large excavations where much plant is required, the digging is frequently sub-let, and a cheap way is by letting it by piecework to a gang of labourers.

In connection with excavation it is interesting to learn that the word "navvy" is a corruption of "navigator." They were called navigators because before the time of railways they were employed in the construction of navigable canals.

Typical specimens only of analyses have been shown in this book; other items and rates can be deduced in a similar manner from the information herein given, with the assistance of the tables of labour constants found in Hurst's "Architectural Surveyor's Handbook." The profit in this and other trades has been added separately to each individual item for the sake of clearness, though it does not follow that the same percentage would be maintained throughout.

Dig, throw out, and form Surfaces for Concrete Paving, &c., not exceeding 12 *in. in Depth.*—An excavator ought to be able to dig out 22 yards super. of common soil, not exceeding 12 in. thick, in a day of 10 hours. Wages $7\frac{1}{2}d.$ per hour. Therefore he can execute 1 yard super. in 1-22nd of that time.

	s.	d.
Wages $7\frac{1}{2}d.$ per hour × 10 hours = $75d.$, or $6s.\ 3d.$ per day.		
22 yards super. are dug in one day, $\therefore \frac{6s.\ 3d.}{22}$ = per yard super.	0	$3\frac{1}{2}$
Add profit, &c.	0	$0\frac{1}{2}$
Total price per yard super.	0	4

Or this might be put: 22 yards super. are dug in a day of 10 hours, or about 1 yard super. per half-hour; therefore—

	s.	d.
1 yard super. per half-hour at $7\frac{1}{2}d.$ per hour, say...	0	$3\frac{1}{2}$
Add profit, &c.	0	$0\frac{1}{2}$
Total price, as before	0	4

Digging and throwing out over Areas above 12 *in. in Depth, including levelling Surface or forming Falls.*—A man would

dig and throw out on an average 9 yards cube per day in common ground; therefore—

	s.	d.
Wages $7\frac{1}{2}d$. per hour × 10 hours = $6s. 3d$. per day; 9 yards cube are dug in 1 day, $\therefore \frac{6s.\ 3d.}{9} =$	0	$8\frac{1}{4}$
Add 15 per cent. profit, &c.	0	$1\frac{1}{4}$
Total price per yard cube	0	$9\frac{1}{2}$

In made ground or light soil a man would dig 13 to 15 yards, in clay or gravel 5 to 7 yards a day, and in chalk 5 yards, these being averages. It was found by experiment in 1856, at Plumstead Rifle Range, near Woolwich, that a navvy could excavate 8 cubic yards of clay per day of 10 hours; but the capabilities of workmen vary, and so does the nature of clay. In hard ground, where picking is required, from 3 to 5 cubic yards would be excavated, and 2 yards hard rock requiring blasting. Such data being known, the prices for various soils can be analysed and worked out in the same way as the foregoing.

Steam Excavating.—The following has been condensed from an interesting article on "Steam Excavators," by Mr. Arthur Bowes, A.M.I.C.E., which recently appeared in the *Building World*:—

The "Ruston-Proctor" machine will do as much work as 60 or 70 men, and the cost of excavating may be reckoned from 2*d*. to 6*d*. per yard cube; the harder the material the greater the saving. On the Manchester Ship Canal a 10 h.-p. "Ruston-Proctor" machine, with buckets of $1\frac{1}{2}$ yards cube capacity, removed 67 yards cube per hour of soft running sand and silt at a cost of $6\frac{1}{2}d$. per yard cube, which included tipping on spoil bank. Although 1,100 yards cube per day of 10 hours have been done by these machines, 600 to 700 yards is a fair average.

A "Wilson" excavator will dig 400 to 630 yards cube per working day, at a rate of 1*d*. to 6*d*. per yard delivered into waggons, a gang of 14 men being required.

A "Whitaker" machine will do as much as 720 yards cube per day, but the average is 500 yards at a price of $\frac{3}{4}d$. per yard. The buckets are $1\frac{1}{2}$ yards cube capacity, the crane 10 tons, and the total weight of the machine 32 tons.

French and German steam excavators are particularly useful for digging in light soil or stiff clay, and to a depth of 16 or 20 ft. at a time. The average day's work is 1,200 to

1,500 yds. cube at a cost of 5*d*. per yard. They require 35 men in attendance.

Stationary or travelling steam cranes may be employed to work iron or wooden skips, which are like large buckets or boxes respectively, and hold about 1 yard cube, made to discharge from the crane over a waggon. Woodford's patent iron skips are best.

In working grabs, the cost in some cases may be taken as about half the price of hand labour; the saving is greater when under water. When dredging Limerick harbour with a Priestman's grab the average cost of dredging and discharging was $1\frac{3}{4}d$. per ton.

Digging and throwing out in Trenches, including levelling Bottom, and fixing and removing Shoring and close Planking where required, not exceeding 6 *ft. deep.*—Trenches and tunnels are expensive to excavate on account of the confined space and labour in trimming sides. In tunnelling, for instance, 2 yards cube may be a very good day's work. The least width in which a navvy can dig comfortably with his whole body in the trench is about 2 ft. 6 in. Work in trenches thus costs 20 to 30 per cent. more than digging over areas where the labour is not cramped. The soil is merely deposited at a safe distance (of, say, 2 ft.) from the edge of the trench, from whence it is wheeled or carted away. Take common ground: A man would here be able to manage only 8 yards cube in one day, as there is a limited space to work in, and the soil has to be pitched out one "throw." A throw is taken to be 6 ft., but sometimes 5 ft. high; and when a trench exceeds that depth stages must be provided. Therefore—

	s.	*d.*
8 yards cube per day, wages at 6*s*. 3*d*. per day as before, and $\frac{6s.\ 3d.}{8} =$	0	$9\frac{1}{4}$
Add for trimming sides, fixing planking, &c.	0	$1\frac{1}{4}$
	0	$10\frac{1}{2}$
Add 15 per cent. profit, &c.	0	$1\frac{1}{2}$
Total price per yard cube	1	0

For made ground allow 12 yards per day, 5 or 6 yards for clay or gravel, 3 yards for chalk, and 1 yard for hard rock requiring blasting.

Add for each additional 6 *ft. in Depth, the first* 6 *ft. being paid for under last Item.*—In shovelling materials it is usually reckoned that a man can throw the stuff horizontally

6 to 10 ft., or upwards 4 to 6 ft., so that if the depth of the cutting exceeds this the earth will have to be thrown first on to a stage, and then lifted again by another set of labourers. A man will throw out 22 yards cube of common soil in one day. This is equivalent to about half an hour for labourer or navvy per cubic yard for each extra throw. As before—

	s.	d.
$\frac{6s.\ 3d.\text{ wages per day}}{22\text{ yards cube per day}} =$	0	$3\frac{1}{2}$
Add for staging or planking, where necessary	0	$0\frac{1}{2}$
	0	4
Add profit, &c.	0	$0\frac{1}{2}$
Total price per yard cube	0	$4\frac{1}{2}$

For made ground allow 30 yards per day, and for clay or gravel 17 yards.

Spreading and Levelling in Layers not exceeding 12 *in. deep.*—A man can level from heaps without throwing 60 yards cube of common soil per day of ten hours, so the price is simple—

	s.	d.
Wages $7\frac{1}{2}d.$ per hour × 10 hours = rate of 60 yards cube ...	60)6	3
Rate of 1 yard cube...	0	$1\frac{1}{4}$
Add profit, &c.	0	$0\frac{1}{4}$
Total price per yard cube	0	$1\frac{1}{2}$

Return, fill in any Depth, including Spreading, Levelling, and well Ramming; but exclusive of Wheeling, or Carting.—This is for filling in and ramming against sides of walls as they are being erected a portion of the earth already excavated, which has been placed alongside the trenches in spoil heaps. The cubical contents of cavity filled in is measured. The work is merely labourer's, and a man will fill in 22 yards cube per day, a rammer attending on each filler. Wages of each, $6\frac{1}{2}d.$ per hour, or 5*s.* 5*d.* a day; and 5*s.* 5*d.* × 2 = 10*s.* 10*d.* Therefore—

	s.	d.
$\frac{10s.\ 10d.\text{ wages per day}}{22\text{ yards cube per day}} =$	0	6
Add profit, &c.	0	1
Total price per yard cube	0	7

Forming Puddle-walls, filling to Coffer-dams, &c., with Clay well worked and rammed in 6-in. Layers.—This is for thick masses, the clay being worked about in layers, with sufficient water to make it pasty, and well cut, cross-cut,

and kneaded. An excavator should temper 4 yards cube a day, or 1 yard cube in 2½ hours. Clay in London for puddling costs 7*s*. 6*d*. per yard cube, but much less in the country. The analysis would be :—

	s.	d.
Clay, clean yellow, for puddle, delivered in London	7	6
Water for working it up, say...	0	1
Labour, 2½ hours at 7½*d*.	1	6¾
	9	1¾
Add 15 per cent. profit, &c.	1	4¼
Total price per yard cube	10	6

Digging for Post Holes under ¼-yard cube, including Filling in and Ramming.—The following is from an actual case, where 7,112 holes were dug for planting young saplings, which would be equivalent to excavating similar ones for posts. The holes were 1 ft. by 1 ft. by 1 ft., in common soil, and placed chequerwise 4 ft. apart, centre to centre, in adjacent plots. A gang of about a dozen ordinary labourers were engaged, and for the 7,112 holes they took 2,868 hours digging only, 938 hours filling in, and 325 hours ramming. Time occupied, eight weeks. Wages, 6½*d*. per hour.

An expert nurseryman came for 15 days to superintend the planting only, the holes having been dug ready for him before he arrived. The detail therefore appeared—

	£	s.	d.
2,868 hours digging only, at 6½*d*.	77	13	6
938 hours filling in, at 6½*d*.	25	8	1
325 hours ramming, at 6½*d*.	8	16	0½
	111	17	7½
Travelling expenses and return of foreman nurseryman ...	2	2	5
Lodging or hotel allowance of ditto, 15 days at 10*s*. per day	7	10	0
Pay of ditto, 15 days at 10*s*. 6*d*. per day	7	17	6
	129	7	6½
Add 15 per cent. profit, &c.	19	8	1½
7,112)	148	15	8
Price per hole	0	0	5

The above price of 5*d*. per hole is for an extremely large number at one time, but for ordinary fewer numbers the rate would be 6*d*. per hole, as shown under Prices for "Excavating."

Removing.

Earthworks require careful planning to avoid long distances for removal, and to manœuvre the spoil *down* hill, instead of the extra labour and expense if raised. The systems adopted

greatly affect the cost, and comprise :—*Barrow runs*, *horse and cart*, and *rail transport* (this latter including hand trolleys, horse waggons, and trucks drawn by locomotives or by ropes worked by stationary engines).

A barrow run is variously taken at 18 yards, 20 yards, 22 yards (one chain), or 25 yards. Removing by wheelbarrows is called "wheeling." In the War Department Schedule wheeling is paid for by the first run not exceeding 50 yards horizontal and 5 ft. rise; additional runs are 25 yards long. Each foot of rise is considered equal to 6 ft. or 9 ft. on the level. A large navvy's barrow holds one-tenth of a cubic yard, and is run on 11 in. by 3 in. planks to avoid friction and to give speed. As gradients in transport ways increase cost, the steepest inclination for barrows should not exceed 1 in 12, but the practical limits are 1 in 30. With a length of one run two barrows can be kept going without waiting, and for the cost add 1*d.* per yard cube per run, in addition to the cost of getting and filling. The economical limit for barrows is therefore small, and may be reckoned at two runs, or, say, 50 yards.

A horse and cart is serviceable beyond the 50 yards, and up to about 100 yards, if the surface of the ground is suitable. A dobbin cart may be used, and is one running on three wheels, and holding about $\frac{3}{4}$-yard cube. It is drawn by one horse, and guided and tipped by the man in attendance. A horse can draw 150 lbs $2\frac{1}{2}$ miles an hour for 8 hours, or say a load of $1\frac{1}{2}$ cwt. 20 miles per day. The practical economical gradient for a horse and cart is 1 in 40.

Rail transport, or "leading" material, as it is termed, is advisable for greater distances than the foregoing 100 yards if for large excavations. It is performed in dobbin carts, or in earth or tip waggons, holding from $1\frac{1}{2}$ to 3 yards cube, drawn on temporary rails by horses, locomotives, or wire ropes worked by stationary engines. An earth waggon holds as much as 20 or 30 wheelbarrows, and goes one-fifth faster, being equal, therefore, to 24 or 36 barrows. For short distances under half a mile, and for small quantities, the carts would be employed, and tramways and perhaps light railways for more extensive removal. For railway embankments and cuttings, locomotives are better than carting for distances over $1\frac{1}{4}$ miles. When large excavations are over 20 ft. deep, the material may be raised by vertical or inclined lifts, worked as single or double horse runs, or even as steam lifts ; but for less depths such would not be economical. On temporary rails each foot of ascent is equivalent to 150 ft. on the

horizontal, but the practical economical gradient is 1 in 100. A higher up-throw, an unfavourable lifting, an unnecessary moving of earth, adds to cost; good plant and tools, and well formed ways are essential. A barrow carrying 2 ft. cube without a plank run will carry 3 ft. cube with one; a tip cart carrying 8 to 10 ft. cube without, will carry 15 to 18 ft. cube with, a good temporary way. It is generally better to throw earth away than to lead it 3 miles.

Wheeling or removing Stuff from Excavations, in Addition to the foregoing Items, not exceeding 50 *yards, including filling the Barrows, &c., and depositing Stuff.*—This is for solid contents, measured before the ground is broken up, and called "hole measured," the amount of which is obtained in the Quantities by deducting the filling and ramming from the digging and throwing out. Owing to the interstices, the increase in bulk of earth and clay when dug is one-fourth, which must be remembered when taking away the spoil. Sometimes the stuff is specified to be removed "off the site," in which case the total distance should be stated.

A labourer can wheel and tip in a day 35 cubic yards of earth, one run distant and return; to save time, he will use two barrows, the one which he wheels, and the other to be left behind for filling during his absence. Thus, one filler can attend on one wheeler. In a long road, a platform or passing place is formed at the end of each respective run, and it is to each of these stages that the navvy wheels his loaded barrow, and returns to the preceding one with an empty barrow, where he should find another loaded one awaiting him. Rankine says: "The proportion of wheelers to shovellers may be estimated approximately by the fact that a shoveller takes about as long to fill an ordinary barrow with earth as a wheeler takes to wheel a full barrow about 100 ft. on a horizontal plank, and return with an empty barrow."

	s.	*d.*
Wheeling per yard cube $= \dfrac{5s.\,5d.\text{ wages per day (at }6\tfrac{1}{2}d.\text{ per hour)}}{35\text{ cubic yards per day}} =$	0	$1\frac{3}{4}$
Filling per yard cube = ditto ... ... =	0	$1\frac{3}{4}$
	0	$3\frac{1}{2}$
Add profit, say	0	$0\frac{1}{2}$
Total price per yard cube	0	4

It is evident that the nature of the soil will affect the proportion of fillers and wheelers to each excavator. For removing loose stuff 2 fillers and 2 wheelers will be required

to each getter, who excavates quickly; for compact earth 1 filler and 1 wheeler will be needed to each getter, whose digging balances the labour of removal; for hard clay 2 getters will be required to 1 filler and 1 wheeler; and in rock as many as 3 getters will be necessary to keep 1 filler and 1 wheeler going. See Table in Memoranda.

Add for Removing every additional 25 *yards up to* 100 *yards from Starting-point.*—The filling of barrows being paid for under last item, this is simply for half the cost of wheeling under the same, as the distance is now only 25 yards (or one run) instead of 50 yards (or two runs).

	s.	d.
Half the cost of wheeling as before, $1\frac{3}{4}d. \div 2$	0	$0\frac{3}{4}$
Add profit, say	0	$0\frac{1}{4}$
Total price per yard cube	0	1

This agrees with the common price of 1*d.* per yard cube per run for removing only in large excavations.

Removing over 100 *yards, and not exceeding* 1 *furlong, and Depositing.*—This is for carting from the 100 yards, horse labour being a very expensive item. For a horse and cart the practical economical gradient is 1 in 40. A man will fill into a cart the same amount of earth he will pitch out of a trench at one throw—viz., 22 yards cube in one day. The rate for cartage, horse, cart, and driver, is 12*s.* 6*d.* per day; and 22 yards cube can be removed 1 furlong, deposited, and returned in that time, including detention. The driver should also help to fill the cart.

	s.	d.
Filling carts $= \dfrac{5s.\ 5d.\ \text{labourer's wages per day}}{22\ \text{yards cube per day}} =$	0	3
Carting, depositing, and returning $= \dfrac{12s.\ 6d.\ \text{cartage per day}}{22\ \text{yards cube per day}} =$	0	$6\frac{3}{4}$
	0	$9\frac{3}{4}$
Add profit, &c.	0	$1\frac{1}{4}$
Total price per yard cube	0	11

Add for every Furlong in addition.—A furlong, 220 yards or one-eighth of a mile, is taken as the standard run for carting. This item is merely carting for the extra distance, the filling, depositing, and delays being accounted for under last head. The transport would now be about four times as quick—that is, the value would be one-fourth of half the cartage at $6\frac{3}{4}d.$ (as $6\frac{3}{4}d.$ is for the distance over 100 yards and not exceeding 1 furlong, about *half* a furlong), or, say, 1*d.* per yard cube or

load, including profit. When the distance is over half a mile, it will be more economical to use waggons on rails. A horse, cart, and driver can go one mile and return one mile, occupying $1\frac{1}{2}$ hours, to obtain a load of gravel. Contractors allow 16 to 20 miles a day travelling for their horses, but this includes time lost in loading. The usual load for a horse and cart on an ordinary metalled road, where there are no steep hills, is $1\frac{1}{2}$ tons ; on a very level road a good horse will draw 2 tons. Horses are costly.

Basketing Earth or Rubbish of any kind, as from the Interior to the Outside of a Building, any Floor.—Removing earth or rubbish in baskets is only resorted to where a barrow cannot be managed, as in carrying stuff up or down steps. A basket holds a bushel, or $\frac{1}{21}$ of a cubic yard. It therefore contains half as much as a barrow, with run of 25 yards, and the labour of carriage would thus be twice as great, involving as it does double the number of journeys. The cost of filling would be practically the same as for wheelbarrows, with perhaps a slight increase of labour.

	s.	d.
Conveyance of baskets, twice cost of wheeling barrows at $\frac{3}{4}d$. ...	0	$1\frac{1}{2}$
Filling ditto, same as filling barrows, but with slight increase...	0	2
	0	$3\frac{1}{2}$
Add profit	0	$0\frac{1}{2}$
Total price per yard cube	0	4

Carting Rubbish and finding a Shoot, not exceeding one Mile.—In London rubbish is carted away and a shoot found for 3*s*. per load, reduced to 2*s*. 6*d*. in the suburbs. Every additional mile is reckoned at 1*s*. Leaning, in his "Notes on Building Prices," states : "Cartage in a city like London will cost more than in its suburbs or the country, because of the congested traffic ; it should also be remembered that in a hilly neighbourhood the cartage of fewer loads in a day, and consequent greater cost, must be allowed for. A rough engineering axiom is 'one shilling a load a mile.' Assuming that a horse, cart, and man can in a day cart ten loads each a mile at 1*s*. per load, we thus have a result of 10*s*. per day. A common valuation of a load on a return journey from an original delivery is one-half the price of the latter. . . . An approximation to the usual charge of stone merchants for cartage is 5*s*. per load of $1\frac{1}{2}$ tons within four miles. Cartage of deals from the Surrey Commercial Docks to St. Paul's or equal distances, 8*s*. per standard ; ditto imber, 3*s*."

TURFING.

Cutting or taking up Grass Sods any reasonable size, and Rolling and Stacking for use.—Three men will cut 100 sods per hour, size being about 24 in. by 12 in. by 3 in. = 200 ft. super. Therefore take half of this for price of 100 ft. super.

	s.	d.
3 excavators cutting, 3 hours at $7\frac{1}{2}d.$	1	$10\frac{1}{2}$
Add for rolling and stacking...	0	$3\frac{1}{2}$
	2	2
Add profit, &c.	0	4
Price of 200 ft. super	2)2	6
Price of 100 ft. super	1	3

CHAPTER VI.—CONCRETOR.

MEMORANDA.

A foot cube = 0·781 striked imperial bushel.
A striked imperial bushel = 1·284 ft. cube.
,, ,, ,, = $1\frac{1}{4}$ ft. cube approximately.
,, ,, ,, = $\frac{1}{21}$ yd. cube.
,, ,, ,, = a box measuring internally 13 in. × 13 in. × $13\frac{1}{8}$ in. = 1·28 ft. cube.
A heaped imperial bushel = 1·625 ft. cube.
A striked Winchester bushel = 1·244 ft. cube.
A cubic yard = 21 striked bushels (21 striked bushels × 1·284 ft. cube = 27 ft. cube nearly), of sand, earth, &c.
,, ,, = 17 heaped bushels (17 heaped bushels × 1·625 ft. cube = slightly more than 27 ft. cube), of sand, earth, &c.
,, ,, = 16 striked bushels of stone lime.
A coke chaldron = 36 heaped imperial bushels.
Coke breeze weight = 9 cwt. per yd. cube = 37 lbs. per ft. cube.

Weight of Concrete.

Concrete	(6 broken ballast, 1 sand, and 1 cement)	weighs per	ft. cube	142 lbs.
,,	(6 gravel, 1 sand, and 1 cement)	,,	,,	142 lbs.
,,	(6 broken stone, 1 sand, and 1 cement)	,,	,,	134 lbs.
,,	(6 broken brick, 1 sand, and 1 cement)	,,	,,	122 lbs.

Lime concrete weighs 4 lbs. less per ft. cube.
Breeze concrete, 1 cement to 5 breeze, weighs 80 lbs. per ft. cube.

Breaking Stones, &c.

A labourer can break per day (measured after breaking):—

4	yds. cube	of brick to 3 in. cube.
2	,,	of sandstone to 2 in. cube.
1	,,	of hard limestone to 2 in. cube.
$\frac{1}{2}$	,,	of granite to 2 in. cube.

Portland Cement.

1 bushel of Portland cement	... ...	= 112 lbs.
2 bushels ,, ,,	... ...	= 1 bag.
1 bag ,, ,,	... ...	= $2\frac{1}{2}$ ft. cube.
1 bag ,, ,,	... ...	= 2 cwt.
10 bags ,, ,,	... ...	= 1 ton.
1 ft. cube ,, ,,	... ...	= 84 lbs.
1 cental, or trade bushel, London custom	...	= 100 lbs.
1 bag, or sack, ,,	...	= 200 lbs.
1 bag, or sack, ,,	...	= 2 centals.
11 bags, or sacks, ,,	...	= 1 yd. cube.
1 yd. cube, ,,	...	= 1 ton.
1 cask, or 4 centals, net	...	= 400 lbs.

Water.

1 gallon of water = 10 lbs.	1 ton of water = 36 ft. cube.
1 ft. cube ,, = $62\frac{1}{2}$ lbs.	1 ,, ,, = $1\frac{1}{3}$ yd. cube.
1 ,, ,, = $6\frac{1}{4}$ gals.	1 ,, ,, = 224 gals.

PRICES.

Concrete, 1 to 6, for Foundations.

The following prices include mixing, wheeling, hoisting or lowering not exceeding 30 ft., depositing, ramming, and profit. Add 1*s*. per yard cube for hoisting every additional 10 ft., and 6*d*. for lowering.

Description.	Grey or local Stone Lime.		Hydraulic or Blue Lias Lime.		Roman or Medina Cement.		Portland Cement.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Concrete, 1 to 6, in foundations for walls, composed of screened Thames ballast, or pit gravel, with sufficient sand to fill the interstices .... per yd. cube	12	0	12	8	15	0	16	9
Ditto, composed of broken brick, or old concrete, 2 in. cube, with sufficient sand............ per yd. cube	13	3	14	0	16	6	17	8
Ditto, composed of broken rag or similar stone, 2 in. cube, with sand.................. per yd. cube	18	0	22	6	24	6	26	3
Add to foregoing if spread over surfaces in thicknesses of 1 ft. and under .... per yd. cube	1	0	1	0	1	0	1	0
Add if above foundations in retaining walls, underpinning, &c. per yd. cube	1	6	1	6	1	6	1	6
Add if in blocks, including moulds, and setting in cement per yd. cube	—		—		—		8	6
Add if executed between high and low water mark, including protection against the tides per yd. cube	—		—		—		3	0
Forming 3 in. chamfer or nosing, straight .... per ft. run	0	2	0	2	0	3	0	3
Ditto, ditto, curved .... ,,	0	3	0	3	0	$4\frac{1}{2}$	0	$4\frac{1}{2}$
Forming rebate or groove, under 6 in. girth, straight ......per ft. run	0	3	0	3	0	4	0	4
Ditto, ditto, curved............ ,,	0	5	0	5	0	6	0	6

Concrete for Paving, Floors and Roofs.

The following prices include mixing, wheeling, hoisting or lowering not exceeding 10 ft., depositing, ramming, and profit. Add $\frac{1}{2}d.$ per yard super. per inch in thickness for hoisting every additional 10 ft., and $\frac{1}{4}d.$ for lowering.

Description.	Hydraulic or Blue Lias Lime.	Portland Cement.
	s. d.	*s. d.*
Concrete bed, 1 to 5, under boarded floors, tile paving, &c., composed of clean porous material such as hard-burnt bricks, &c., 1-in. cube, with a proper proportion of fine stuff, 4 in. thick per yd. sup.	2 0	2 9
Ditto ditto 6 in. thick ,,	2 10	3 9
Ditto ditto 9 in. ,, ,,	4 0	5 3
Ditto ditto 12 in. ,, ,,	5 4	6 9
Concrete, 1 to 4, in paving, floors, roofs, &c., $\frac{3}{4}$-in. cube, composed as above, laid and floated, 4 in. thick .... per yd. sup.	—	3 4
Ditto ditto 6 in. thick ,,	—	4 6
Ditto ditto 9 in. ,, ,,	—	6 3
Ditto ditto 12 in. ,, ,,	—	8 0
Add if surface is finished with granite siftings, 1 cement to 2 siftings, $\frac{1}{2}$ in. thick, incorporated whilst unset and floated to a fair surface... per yd. sup.	—	0 4
Add if exposed underside is rendered with a thin coat of lime putty........ per yd. sup.	—	0 4$\frac{1}{2}$
Ditto if soffit is rendered with a thin coat of 1 cement and 1 sand........ per yd. sup.	—	1 3
Floating surfaces of concrete and bringing to a fair face (included in foregoing)........ per yd. sup.	—	0 10
Concrete for fireproof floors, 1 cement, 3 coke breeze, 2 broken brick, 1$\frac{1}{4}$-in. cube, 1 coarse sand, filled in between iron joists, levelled and rammed, left spade face on top to receive screeding, and roughed on underside to receive plastering, 4 in. thick........ per yd. sup.	—	1 9
Ditto ditto ditto 6 in. thick ,,	—	2 6
Extra to forming 4 in. projection to 6 in. flat concrete roof and throating on underside...... per ft. run	—	0 4
Forming channels in concrete not exceeding 6 in. girth .... per ft. run	—	0 3
Dished outlets to ditto .... each	—	1 6

		s.	d.
Dry filling of broken brick, 2-in. cube, under concrete floors, s.o.	... per yd. cube	3	10
Ditto, but spread, levelled, and rammed, 4 in. thick,	per yd. sup.	0	7
Ditto ditto ditto 6 in. thick,	,,	0	9½

Materials.

		s.	d.
Ballast, burnt clay	... per yd. cube	4	6
Ballast, Thames	,,	5	0
Cement, Portland, including use of bags	per bushel	1	10
Ditto, per bag weighing 2 cwt., and containing 2 bushels	each	3	8
Ditto, ditto, 200 lb., containing 2 centals	,,	3	4
Ditto, in large quantities	per ton	32	0
Cement, Roman	per bushel	1	9
Clay, clean yellow, for puddle walls, &c. ...	... per yd. cube	7	6
Coke breeze	,,	3	6
Earth, dry vegetable, and carting to spot required	,,	5	6
Gravel, clean, best local	,,	6	6
Lime, including use of bags, unslaked, ground fine, stone, grey Dorking	per bushel	0	8¼
Ditto ditto ditto per yd. cube of 8 sacks or 16 bushels		11	0
Lime, including use of bags, unslaked, ground fine, lias, Lyme Regis	per bushel	0	10
Ditto ditto	... per yd. cube	12	6
Ditto ditto	per ton of 30 bushels	25	0
Lime, including use of bags, unslaked, ground fine, white chalk	per bushel	0	7¼
Rubbish, hard dry, or broken bricks, 2-in. cube, including profit	... per yd. cube	3	10
Ragstone, broken to 2-in. gauge for concrete ...	,,	12	0
Breaking old bricks into 2-in. or 3-in. cubes for concrete, filling, &c., hand labour only ...	... per yd. cube	1	4¼
Breaking ragstone into 2-in. cubes, hand labour only	,,	2	9
,, ,, ,, ,, machine labour only	,,	1	0
Sand, pit or river, clean sharp, unwashed	,,	6	9
,, ,, ,, washed	,,	10	0
,, ,, ,, washing, labour only ...	,,	1	7
,, ,, ,, screening ,, ...	,,	0	6½
,, sea, washed and dried	,,	7	0
Water, clean, fresh, including delivery under one mile	per ton of 224 gals.	3	6
,, ,, ,, supplied by East London Water Company	per yd. cube of concrete	0	1
Wages, excavator	per hour	0	7½
,, labourer	,,	0	6½
,, ganger	,,	0	8

ANALYSIS.

Materials.

Burnt Ballast.—The term "ballast" is derived from the use of similar materials placed in the hold of a ship to keep it steady when there is no cargo. It is much employed in

the shape of broken stone, gravel, &c., for making concrete and forming roads, as well as on railways. When ready-made ballast is not procurable, burnt-clay ballast is used, which is made from any clay suitable for brickmaking. That for concrete is produced by making a fire of "slack," or small coal, cinders, breeze, ashes, &c., and covering this in with lumps of clay or brick earth; more fuel is scattered over this, then more clay, 6 in. thick, and so on in alternate layers. It may be cooking, so to speak, for weeks. In this way as much ballast can be made as will be wanted. It is most important that the clay should be thoroughly burnt; otherwise it will return to its natural condition. Burnt ballast by itself, however, is not to be recommended as an aggregate for concrete where strength and durability are required, as it is too weak in tension and compression. If used with a harder aggregate, such as broken bricks, stone, or gravel, it is all right. The clinker refuse from the "Newington" dust destructors at Meopham is much more suitable, and its greater cost would be more than repaid with the better results obtained.

It takes about 2 cwt. of fuel to burn 1 cubic yard of clay, and calculating small coal at 16*s.* per ton, the cost of production would be:—

	s.	*d.*
1 cubic yard of clay in the field	1	6
Excavating ditto and spreading	0	11
Labour in burning	0	6
2 cwt. coal at 16*s.* per ton	1	7
Total price per yard cube	4	6

Sometimes only 1 cwt. of coal is allowed per yard cube of clay.

A chaldron of breeze at 9*s.* burns from 9 to 12 cubic yards of clay. Proper clay can sometimes be obtained from the building site, in which case its price would be eliminated.

Thames Ballast.—This is a natural mixture of gravel or shingle with sand, in the proportion of two of the former to one of sand; that from above the bridges is the cleanest. Therefore no sand need be added when this is used for concrete. Thames ballast costs 5*s.* or 6*s.* per yard cube.

Breeze.—So-called "breeze" is coke from which less gas has been extracted than from ordinary coke, and should be washed three times to remove all dust and earthy substance. Coke breeze can be obtained from any gasworks. A coke chaldron of the London district is a measure containing

36 heaped imperial bushels. Breeze is light, and therefore much used for concrete on upper floors. It weighs 9 cwt. per yard cube, or 37 lbs. per ft. cube. Price, 3*s*. 6*d*. per yard cube.

Portland Cement.—This is an artificial combination of chalk and clay, in the proportion of about 75 per cent. chalk to 25 per cent. clay, and is so named from a supposed resemblance in its colour to Portland stone. The heaviest qualities set the slowest, but are the best, as they ultimately attain the greatest strength. The usual weight specified is 112 lbs. or 1 cwt. per striked bushel.

Each sack or bag contains 2 bushels, weighing 2 cwt., which gives 10 sacks to the ton. By London custom the bags contain 2 centals, or trade bushels, of 100 lbs. each, giving 200 lbs., net, of cement per sack; and the manufacturers quote, not for a ton of 2,240 lbs., but for a "ton of 11 sacks."

For the general building trade, however, the custom varies considerably. In some places the sack contains 2 cwt. net, and in other districts 204 lbs. net, which latter equals 11 to the ton. Now if 1 bag = 2 cwt. = 2 bushels, and 1 bushel = $1\frac{1}{4}$ ft. cube, therefore 1 bag = $2\frac{1}{2}$ ft. cube, and 11 bags × $2\frac{1}{2}$ ft. cube = $27\frac{1}{2}$ ft. cube. Thus 1 ton of cement = 1 yard cube.

The bags themselves weigh 2 or $2\frac{1}{2}$ lbs. each, and should not be included in the weight of the cement. Those of No. 1 canvas cost 18*s*. per dozen, and those of jute, 7*s*. per dozen, when new. When the cement merchants supply them each bag is charged 1*s*. 1*d*., of which 1*s*. is refunded to the builder if he returns the bags within one month and pays carriage; the difference covers wear and tear. It is to the buyer's interest to have his own bags, as it saves trouble and manufacturer's charges.

Cement should be bought directly from the maker to save the middleman's profit, and a number of the Thames and Medway cement merchants have depôts in London for this purpose. It should also be purchased in large quantities, such as a barge-load at a time, if possible, and the saving thus effected would soon pay for the cost of a shed for storage. Railway companies, too, specify a minimum rate for 4 tons. Cement thus received can likewise be at once aërated by spreading it out about a foot thick on the dry floor of the shed, which is very important. Or if there is not sufficient storage accommodation, good terms can still be obtained by contracting for the whole amount, but with

specified instalments. It is an advantage to order delivery a few days forward, as the cement has been made longer and arrives earlier for aëration.

English cement is mostly from the Medway, and of late a combination has been formed of the Associated Portland Cement Manufacturers (900), the output of which is 1,800 tons per week. Cement is also imported from Germany and Belgium. The price at the mills is 25*s.* per ton, and the cost, delivered in London, would be made up thus :—

Detailed Cost of Portland Cement.

		s.	*d.*
Portland cement at mills on Medway, including loading into barges	per ton	25	0
Freight to London, including unloading and wharf charges	,,	1	6
Carting from London wharf, say 3 miles at 1*s.* per mile	,,	3	0
Use of bags, 11 bags per ton at 2*d.* each	,,	1	10
Cost of returning empty bags, say...	,,	0	8
Price per ton delivered		32	0

This works out to 1*s.* 7*d.* prime cost per bushel for large quantities. If delivered by van within a radius of three miles, or to any railway station in London, cement costs 1*d.* per bushel extra. Therefore the inclusive price delivered on building site may be put down at 1*s.* 10*d.* per bushel. A convenient rate given for country districts is 2*s.* 6*d.* per bushel.

Cement is exported in fir casks, lined with stout brown paper to prevent leakage, and bound with ten wooden hoops and two iron ones, each generally containing 4 centals or 400 lbs. (net). Price 5*s.* 6*d.* per cask, including 1*s.* 6*d.* for cost of barrel itself. Six casks = 1 ton.

Lime.—The "stone" or grey-chalk lime commonly used in London is obtained from the lower chalk beds in the South of England at Dorking, Lewes, Petersfield, Halling, Merstham, &c., and is feebly hydraulic. It weighs about 70 lbs. per bushel. A cubic yard costs 11*s.*, delivered on site, and with 8 sacks (of 2 bushels each), or 16 bushels, to the yard, the charge would be 8¼*d.* per bushel. The ordinary ground Dorking or grey lime is now seldom kept in stock by London merchants, as the ground lias is much stronger, and cheaper also than formerly, and is brought up from the country in large quantities.

When lime is purchased in sacks, it may be bought in the form of ground lime instead of lump at a small increased price, with, of course, a further extra charge for the use of the sacks.

Lias lime, called "blue lias" from the colour of the raw stone, comes mainly from the Midland and South-Western counties, chiefly from such places as Rugby, in Warwickshire; Lyme Regis, in Dorset; and Aberthaw, near Cardiff. It is much more hydraulic than the stone lime. Ground lias lime costs 25*s.* per ton in the Metropolis, delivered on site, and as 2 yards equal 1 ton, the price per yard cube is 12*s.* 6*d.* As there is an average of 30 bushels to the ton, the price per bushel works out to 10*d.*, including use of bags. There are 3 bushels of ground blue lias lime to the bag, or 10 bags make 1 ton. If delivered by van within a radius of three miles, or to any railway station in London, lime costs 1*s.* per yard cube extra.

Brick Rubbish.—This is termed "rubbish" because the broken bricks, &c., of which it is composed are generally obtained from old buildings pulled down; if not, the most inferior bricks brought on to the site must be utilised. Such hard dry material is not only used for concrete aggregate, but as a filling beneath concrete pavements. A labourer can break to 2-in. or 3-in. cube 4 cubic yards per day, or 1 yard in $2\frac{1}{2}$ hours, and putting down 2*s.* for bricks, we have—

	s.	*d.*
Bricks for 1 cubic yard of rubbish, say	2	0
Breaking ditto, $2\frac{1}{2}$ hours labourer at $6\frac{1}{2}$*d.*	1	$4\frac{1}{4}$
	3	$4\frac{1}{4}$
Add profit, &c.	0	$5\frac{3}{4}$
Total price per yard cube, supplied only	3	10

Broken Stone.—The smaller the stone is broken the heavier a cubic yard of it will weigh, as the percentage of vacant space between each stone will be less. Stone, broken to 2-in. gauge for ordinary metalling or concrete, would only be a little more than half the weight of the solid rock. For example, Kentish ragstone weighs 166 lbs. per foot cube $\times\ 27 = \frac{4{,}482 \text{ lbs.}}{2{,}240 \text{ lbs.}} = 2$ tons per yard cube in the solid. This is equivalent to 55 per cent., or, say, 1 ton roundly, per yard cube for the broken stone.

A labourer would break 2 cubic yards (measured after breaking) into 2-in. gauge in a day, equal to 2*s*. 9*d*. per yard. Hard rocks can only be broken at the rate of 1 yard, and granite at half a yard per day. Hand-broken stone is sharper in fracture, as it is done by a blow, and not by gradual pressure, whereas machine-broken stone is often flaky or with rounded edges, and, therefore, not so suitable for concrete.

Stone can be broken much more expeditiously and cheaply by machine than by hand, provided the machine is at the quarry, so as to save the expense of much handling, and that the stone is too tough to be broken economically by hand. The wear and tear of a stone-breaking machine is very considerable, and it has been known to reach as high as 62½ per cent. of the first cost of the machine in one year. If one of Baxter's knapping-motion stone-breakers, with a 16-in. by 9-in. jaw and 6 H.-P. engine, be used, the quantity issuing per day of 10 hours is from 60 to 90 tons, and the metal falls from a screen in various sizes into divisions below. As much as 18 tons have been broken in an hour; but taking 60 tons as an ordinary day's work, the cost of breaking, including the expenses of steam-engine, is as follows:—

	£	s.	d.	£	s.	d.
Labour (4 men getting stone to, and 5 taking it from machine)—9 men at 3*s*. 6*d*. per day	1	11	6			
Engine man at 5*s*. per day	0	5	0			
Feeders, 1 man at 4*s*.	0	4	0			
,, 1 boy at 2*s*. 6*d*.	0	2	6			
				2	3	0
Coals, 5 cwt. at 8*s*. per ton				0	2	0
Oil and tallow				0	1	0
Allow for depreciation and repairs (working 6 months)				0	4	0
Price of 60 tons				60)2	10	0
Price of 1 ton				0	0	10

The sum is therefore 10*d*. per ton; but allowing for time lost in moving from one place to another, the actual cost is 1*s*. per ton, or per yard cube, of broken stone (as already explained), as compared to 2*s*. 9*d*. for the same amount broken by hand—labour only in each case.

Sand.—Sand is pit, river, or sea. The sand used in London comes from the Thames, or from pits at Fulham, or the Drayton district, and costs 6*s*. 9*d*. per yard cube delivered in the City. When screening is necessary the extra price

would be $6\frac{1}{2}d.$, as 1 cubic yard is screened by a labourer in an hour at this wage.

For washed sand, a man will wash a yard cube, measured after washing, in three hours. One-fourth bulk is lost in washing, so allow $1\frac{1}{4}$ yard cube.

	s.	d.
$1\frac{1}{4}$ yard cube sand at 6*s.* 9*d.*	8	5
Labourer washing, 3 hours at $6\frac{1}{2}d.$, say	1	7
Price per yard cube...	10	0

The royalty for obtaining sand or gravel is 6*d.* to 1*s.* 6*d.* per yard cube, according to position and demand, but 1*s.* is a common rate.

Concrete Work.

The making of concrete depends upon—(1) the amount of voids in the aggregate which need to be filled with the matrix; (2) the shrinkage of the matrix as a result of mixing with water; and (3) the compression in bulk of the whole of the materials after mixing, watering, and ramming.

Voids in Aggregate.—The size of the pieces of which the aggregate is composed influences the content of the spaces or interstices between them, and therefore the amount of the lime, cement, and sand, in the matrix to fill these up. The larger the stones the greater will be the voids between, and the vacancies can be best ascertained by actual trial—by filling a water-tight box (a convenient size is 4 ft. 6 in. × 3 ft. × 2 ft. = 27 ft. cube = 1 yd. cube) with materials well wetted to avoid further absorption, and measuring the volume of water it is necessary to pour in to fill up all the interstices. The cavities can be reduced by breaking the stones to as many different sizes as possible, which is very important if good concrete is to be produced, as the cement is intended to unite all the various portions, large and small, of the aggregate, and not to make a mortar simply to occupy the voids. The interstices should be quite filled up with the matrix to get strong solid concrete. Concrete should, in fact, contain as much broken material and as little mortar as possible, and stone-crushing machines produce more irregular fragments, of various sizes, than stones broken by hand, though the latter are sharper.

The following table shows the amount of voids in

various aggregates, and therefore the matrix required to fill up :—

VOIDS IN AGGREGATE.

Description of Aggregate.	Voids per Yard Cube.	
	Ft. Cube.	Per Cent.
Brick, broken $\frac{3}{4}$ in. to 3 in. gauge	13	48
Stone, broken to $1\frac{1}{2}$-in. gauge	$11\frac{1}{3}$	42
,, ,, 2-in. ,, ...	$10\frac{2}{3}$	40
,, ,, $2\frac{1}{2}$-in. ,, ...	10	37
Gravel, of various sized pebbles	10	37
Clean shingle, or burnt clay	9	33
Clean pit sand	6	22
Thames ballast (which contains sand)	$4\frac{1}{2}$	17

Shrinkage of Matrix.—The shrinkage in bulk of the lime and sand, or cement and sand, as a result of mixing with water when made into the mortar or matrix, must also be considered. Cement shrinks 10 per cent. when wetted, and sand 20 per cent. The diminution for lime and sand when mixed together and wetted is one-fourth, or 25 per cent.; and for cement and sand, one-sixth, or 17 per cent. The reduction varies according to the proportion and nature of the ingredients, and a useful table, giving a great deal of such information in relation to various mortars, will be found in Rivington's "Building Construction," Vol. III., which likewise contains other valuable information on aggregates and concrete generally.

Compression of the Whole.—The compression or shrinkage in bulk of the whole of the materials after mixing, watering, and ramming in position, next claims attention. This depends upon the proportion of the concrete, the nature of the aggregate, upon its size, porosity, dryness or dampness, extent of ramming, &c. The greater the voids the greater the diminution. Such diminution may be as much as one-third, or as little as one-twentieth, of the dry mixture, but with ordinary materials one-fifth may be taken as an average. Ramming alone diminishes the bulk by one-tenth. The writer has proved this reduction in concrete in the following manner: —A bottomless box measure, 5 ft. 6 in., by 3 ft. 4 in. by 1 ft. 6 in. = 1 yard cube, was first filled with aggregate for concrete—Portland cement and gravel with sand, mixed dry. This, after being taken out of the box, was twice turned

over and wetted, filled back again, and well rammed, and was then found to have sunk $3\frac{1}{2}$ in., or about one-fifth. Therefore, when this concrete was wetted and rammed, it was reduced one-fifth in bulk, or 20 per cent. Thus 12 measures of this sized box made 10 yards cube of concrete.

All the foregoing lessenings of bulk must be taken into consideration in calculating the additional materials required, but actual experience is the best guide.

Materials for Concrete.—These are ballast, broken stone, broken brick, gravel, shingle, coke breeze, slag from furnaces, &c., for the aggregate; and lime, cement, and sand for the matrix. When the aggregate is very rough and porous, the proportion of cement and sand should be greater, as a good deal is absorbed into the pores of the former.

Water for Concrete.—The amount of water depends upon the materials, their proportions and their absorbent nature. The mixing of neat cement requires 18 per cent., by weight, of water, *i.e.*, 2 gals. per bushel of 112 lbs. = 2 gals. per $1\frac{1}{4}$ ft. cube = 43 gals. per yard cube. Half only of this will be necessary for the whole bulk of the materials, or, generally speaking, about $\frac{3}{4}$ gal. per foot cube = 20 gals. per yard cube of concrete. These amounts agree with practice, for 22 gals. per yard cube were used at Newhaven breakwater, 20 gals. at Spithead forts, where the concrete was 1 to 8, and 18 gals. on the Chatham Dockyard Extension Works. The aggregate should always be damp before mixing, but not dripping wet, so as to avoid undue absorption. Allowing for waste, the safe quantity may be taken as 25 gals. per yard cube.

The cost can be put down at 1*d.* per yard cube, which is the rate allowed by the East London Water Company; in the country it may be *nil.*

Labour for Concrete.—Allow at least 4 men for shovelling and mixing, and 1 for sprinkling water, or 5 to a gang, though a dozen are frequently at work together. There is a ganger superintending besides. About 1 yard cube is mixed at a time, and this set of 6 men altogether can mix, wheel 25 yards (one barrow run), deposit, and ram 20 yards cube per day. This equals $3\frac{1}{3}$ yards cube per man per day, or $2\frac{3}{4}$ hours per man per yard cube—say, 3 hours labourer, which will make up for the slightly higher wages of the ganger.

Table of Concretes.—The following table is a summary of the amounts of materials for concrete as given by various authorities, but adapted and completed by the author for practical use:—

Materials for Concrete per Yard Cube.

Description of Concrete.	Stone Lime.	Hydraulic or Lias Lime.	Portland Cement.	Water.	Thames Ballast (containing sand).	Gravel or Shingle.	Broken Stone, 2-in. cube.	Broken Brick, 2-in. cube.	Sand.	Labour.
	Bushls.	Bushls.	Bushls.	Gallons.	Yds. cube.	Yds. cube.	Yds. cube.	Yds. cube.	Yds. cube.	Hours.
1 stone lime to 6 Thames ballast	4	—	—	25	$1\frac{1}{5}$	—	—	—	—	3
1 ,, ,, 7 ,, ,, ...	$3\frac{3}{4}$	—	—	30	$1\frac{1}{5}$	—	—	—	—	Not given
1 ,, ,, 10 ,, ,, ...	$2\frac{1}{2}$	—	—	30	$1\frac{1}{5}$	—	—	—	—	,,
1 ,, ,, 6 gravel	3	—	—	20	—	$1\frac{1}{10}$	—	—	—	,,
1 ,, ,, 6 shingle, and 2 sand	$3\frac{1}{2}$	—	—	25	—	1	—	—	$\frac{1}{3}$	,,
1 lias lime to 6 Thames ballast...	—	4	—	25	$1\frac{1}{5}$	—	—	—	—	3
1 Portland cement to 3 Thames ballast ...	—	—	7	25	1	—	—	—	—	Not given
1 ,, ,, 4 ,, ,, ...	—	—	$5\frac{1}{2}$	25	1	—	—	—	—	,,
1 ,, ,, 6 ,, ,, ...	—	—	4	25	$1\frac{1}{7}$	—	—	—	—	,,
1 ,, ,, 6 ,, ,, ...	—	—	$3\frac{3}{4}$	25	$1\frac{1}{5}$	—	—	—	—	3
1 ,, ,, 7 ,, ,, ...	—	—	$3\frac{3}{4}$	30	$1\frac{1}{5}$	—	—	—	—	Not given
1 ,, ,, 10 ,, ,, ...	—	—	$2\frac{1}{2}$	30	$1\frac{1}{5}$	—	—	—	—	,,
1 ,, ,, 6 shingle, and 2 sand ...	—	—	$3\frac{1}{2}$	25	—	1	—	—	$\frac{1}{3}$	,,
1 ,, ,, 7 gravel (Potter) ...	—	—	$2\frac{5}{8}$	Not given	—	1	—	—	—	,,
1 ,, ,, 8 ,, (Seddon) ...	—	—	$2\frac{3}{4}$	18	—	$1\frac{1}{10}$	—	—	—	,,
1 ,, ,, 12 ,, (Rivington) ...	—	—	2	50	—	$1\frac{1}{5}$	—	—	—	,,
1 ,, ,, 6 broken stone, & 2 sand	—	—	$3\frac{3}{4}$	25	—	—	1	—	$\frac{1}{3}$	3
1 ,, ,, 6 ,, brick, ,,	—	—	4	12	—	—	—	$1\frac{1}{9}$	$\frac{1}{3}$	Not given

Examples.

Example 1.—*Concrete composed of* 1 *part Stone Lime to* 6 *parts Thames Ballast.*—This ballast contains the necessary sand, of which there is one-third, the rest being gravel. In practice about 33 ft. cube, or $1\frac{1}{5}$ yards cube of ballast are allowed for each cubic yard of concrete, including waste, which will cover the compression of the whole. As there are $4\frac{1}{2}$ ft. cube of voids per yard cube in Thames ballast, this will be the amount of lime required, plus one-fourth for shrinkage of lime and sand matrix when mixed together and wetted. (For reasoning see foregoing pages.) And $4\frac{1}{2}$ ft. cube $\times$ 6 (proportion of 1 to 6) $=$ 27 ft. cube, or 1 cubic yard. Therefore $4\frac{1}{2}$ ft. cube $+ \frac{1}{4} = 4\frac{3}{4}$ ft. cube $\div 1\frac{1}{4}$ ft. cube per bushel $=$ 4 bushels of lime per yard cube. In this and other cases, the proportions of lime or cement and sand should be taken with reference to the bulk of the ballast or shingle before mixing, and not to that of the whole of the materials when added together. For lime concrete the proportion of lime should be in lime powder, either hot ground or slaked lime, and not measured in the lump. Water, 25 gallons. Labour, 3 hours.

	s.	*d.*
$1\frac{1}{5}$ yard cube of Thames ballast at 5*s.*	6	0
4 bushels of stone lime at $8\frac{1}{4}$*d.*	2	9
25 gallons of water	0	1
Mixing, wheeling 25 yards, depositing, and ramming, 3 hours labourer at $6\frac{1}{2}$*d.*	1	$7\frac{1}{2}$
	10	$5\frac{1}{2}$
Add 15 per cent. profit, &c.	1	$6\frac{1}{2}$
Total price per yard cube	12	0

When large quantities are mixed at once, there is a saving in both material and labour, resulting in a corresponding reduction of cost.

It is sometimes convenient to work out the analysis for 6 cubic yards of concrete lumped, taking 6 yards of ballast to 1 yard of lime (plus allowances for diminution), and dividing the total result by 6 to obtain the cost of 1 yard cube. For a proportion of 5 to 1, take 5 yards of ballast and 1 yard of lime (plus allowances for diminution) and so on; so that the value of a larger quantity may be computed, and from that calculate the smaller by division.

Example 2.—*Concrete composed of* 1 *part Lias or Hydraulic Lime to* 6 *parts Thames Ballast.*—In this instance the extra

cost will only be the difference in price between stone lime and lias lime, and the analysis will be as before. When blue lias or hydraulic lime is used in the lump, it should, before mixing, be left to slake for two or three days, by being well covered up with sand, which facilitates the slaking by keeping in the heat. But ground lime is generally preferred.

	s.	d.
$1\frac{1}{5}$ yard cube of Thames ballast at 5*s.*	6	0
4 bushels of ground lias lime at 10*d.*	3	4
25 gallons of water	0	1
Labour as before, 3 hours at $6\frac{1}{2}$*d.*	1	$7\frac{1}{2}$
	11	$0\frac{1}{2}$
Add 15 per cent. profit, &c.	1	$7\frac{1}{2}$
Total price per yard cube	12	8

EXAMPLE 3.—*Concrete composed of* 1 *part Portland Cement to* 6 *parts Thames Ballast.*—The shrinkage for cement and sand matrix when mixed together and wetted is only one-sixth. Therefore $4\frac{1}{2}$ ft. cube voids in aggregate + $\frac{1}{6}$ = $4\frac{2}{3}$ ft. cube ÷ $1\frac{1}{4}$ ft. cube per bushel = $3\frac{3}{4}$ bushels of cement per yard cube. Cement concrete should be laid as soon as mixed.

	s.	d.
$1\frac{1}{5}$ yard cube of Thames ballast at 5*s.*	6	0
$3\frac{3}{4}$ bushels of Portland cement at 1*s.* 10*d.*	6	$10\frac{1}{2}$
25 gallons of water	0	1
Labour, 3 hours at $6\frac{1}{2}$*d.*	1	$7\frac{1}{2}$
	14	7
Add 15 per cent. profit, &c.	2	2
Total price per yard cube	16	9

EXAMPLE 4.—*Concrete composed of* 1 *part Portland Cement to* 6 *parts Broken Stone, 2-in. Gauge, and* 2 *parts Sand.*—This is a very common make of concrete where ballast of any sort is not obtainable. With reference to these proportions Mr. Hurst says: "As a rule 1 cubic yard of broken stone, screened gravel, or clean shingle is required to make 1 cubic yard of concrete; but if the sand be increased beyond the above proportion, the quantity of shingle required is diminished, though in a somewhat less ratio than the sand."

	s.	d.
1 yard cube (27 ft. cube) of stone, broken to 2-in. gauge... ...	12	0
$\frac{1}{3}$ yard cube (9 ft. cube) of pit-sand at 6*s.* 9*d.*	2	3
Carried forward	14	3

	s.	d.
Brought forward	14	3
$\frac{1}{6}$ yard cube ($4\frac{1}{2}$ ft. cube), or $3\frac{3}{4}$ bushels of cement at 1*s.* 10*d.* ...	6	$10\frac{1}{2}$
25 gallons of water	0	1
Labour, 3 hours at $6\frac{1}{2}$*d.*	1	$7\frac{1}{2}$
	22	10
Add 15 per cent. profit, &c.	3	5
Total price per yard cube	26	3

EXAMPLE 5.—*Concrete composed of* 1 *part Portland Cement to* 7 *parts Gravel, or similar Aggregate.*—The following is given in Potter's book on "Concrete," and is for concrete walling 12 in. thick.

	s.	d.
1 yard cube of gravel, or similar aggregate	4	0
$2\frac{5}{8}$ bushels of Portland cement at 2*s.* 6*d.*	6	7
Labour mixing and depositing	2	6
Labour fixing appliances (casing, &c.), and removing same ...	0	9
Use and depreciation of ditto	0	6
Per yard cube	14	4

EXAMPLE 6.—*Concrete Floor,* 5 *in. thick, composed of* 1 *part Portland Cement to* 6 *parts Old Bricks,* $1\frac{1}{2}$*-in. Gauge.*—This example is also from the same source.

	s.	d.
Crushing aggregate of old bricks by steam power	0	8
4 bushels of Portland cement at 2*s.* 9*d.*	11	0
Labour mixing and depositing	2	0
Use and waste of material in timber supports, and labour in preparing, fixing, and removing same	3	0
Finishing surfaces by skimming floor with neat cement, and ceiling with 1 cement to 3 sand	3	0
Per yard cube	19	8

Equals 2*s.* 10*d.* per yard super.

Concrete Bed for Paving, &c., 6 *in. thick.*—A yard super. of concrete 6 in. thick would be one-sixth of a yard cube, to which must be added the extra labour in spreading and levelling. A man ought to do of this about 40 yards super. per day, or, say, one yard in a quarter of an hour.

	s.	d.
$\frac{1}{6}$ yard cube of cement concrete, 1 to 6, at 14*s.* 7*d.* prime cost ...	2	$5\frac{1}{4}$
$\frac{1}{4}$ hour extra labour in spreading and levelling at $6\frac{1}{2}$*d.*	0	$1\frac{1}{2}$
	2	$6\frac{3}{4}$
Add profit, say	0	$5\frac{1}{4}$
Total price per yard super.	3	0

A labourer will mix concrete outside a building, wheel 20 yards, and hoist to an upper floor with a bucket and rope, then spread and ram, 4 in. thick, 5 yards super. per man per day of 10 hours; ditto, 6 in. thick, $4\frac{1}{8}$ yards super. per man per day of 10 hours.

Floating Surfaces of Concrete and bringing to a fair Face.—In the proportion of 1 to 2, 1 bushel of cement and 2 bushels of sand will cover 9 yards super. A bushel = $\frac{1}{21}$ yard cube. On a straightforward job a man can execute 20 yards super. per day, or about 1 yard super. in half an hour.

	s.	d.
1 bushel of Portland cement at 1*s.* 10*d.*	1	10
2 bushels, or $\frac{2}{21}$ yard cube of sand at 6*s.* 9*d.*	0	$7\frac{3}{4}$
Cost of 9 yards	9)2	$5\frac{3}{4}$
Cost of 1 yard	0	$3\frac{1}{4}$
Labour, $\frac{1}{2}$ hour bricklayer at $10\frac{1}{2}d.$	0	$5\frac{1}{4}$
	0	$8\frac{1}{2}$
Add profit	0	$1\frac{1}{2}$
Total price per yard super.	0	10

The above is merely a "fair" face, and does not imply a faultless finished surface for walking upon.

Machine-made Concrete.—When large masses of concrete have to be made for engineering works, it is more economical to employ concrete mixing-machines, the use of which reduces the cost of making to one-third of that done by hand. These machines measure and mix the materials automatically, and will turn out from 10 to 70 cubic yards of concrete per hour. They may be worked by hand-power or by steam; the latter necessitates engine, boiler, rails and tipping-waggons, &c.

Brick Filling.—Broken brick dry filling, 2-in. cube, under concrete floors, and spread, levelled, and rammed, 6 in. thick. A yard super. of this is equal to one-sixth of a yard cube, and there is the labour in spreading and levelling.

	s.	d.
$\frac{1}{6}$ yard cube broken brick rubbish at 3*s.* $4\frac{1}{2}d.$ prime cost ...	0	$6\frac{3}{4}$
$\frac{1}{4}$ hour extra labour in spreading and levelling at $6\frac{1}{2}d.$	0	$1\frac{1}{2}$
	0	$8\frac{1}{4}$
Add profit	0	$1\frac{1}{4}$
Total price per yard super.	0	$9\frac{1}{2}$

CHAPTER VII.—DRAINLAYER.

MEMORANDA.

Table of Drain Pipes.

Diameter.	Net length when laid.	Thickness of Pipe.	Depth of Socket.	Thickness of Socket.	Weight per Pipe.	Number per Ton.
4-in. stoneware	2 ft.	$\frac{5}{8}$ in.	$1\frac{1}{2}$ in.	$\frac{5}{8}$ in.	18 lbs.	125 of 2-ft. lengths.
6-in. ,,	2 ,,	$\frac{11}{16}$,,	$1\frac{3}{4}$,,	$\frac{11}{16}$,,	28 ,,	80 of 2-ft. lengths.
9-in. ,	2 ,,	$\frac{13}{16}$,,	2 ,,	$\frac{13}{16}$,,	53 ,,	42 of 2-ft. lengths.
12-in. ,,	2 to $2\frac{1}{2}$ ft.	1 ,,	2 ,,	1 ,,	90 ,,	25 of 2-ft. lengths.
15-in. ,,	2 ,, $2\frac{1}{2}$,,	$1\frac{1}{4}$,,	$2\frac{1}{4}$,,	$1\frac{1}{4}$,,	125 ,,	18 of 2-ft. lengths.
18-in. ,,	2 ,, $2\frac{1}{2}$,,	$1\frac{3}{8}$,,	$2\frac{1}{2}$,,	$1\frac{3}{8}$,,	187 ,,	12 of 2-ft. lengths.
21-in. ,,	2 ,, $2\frac{1}{2}$,,	$1\frac{3}{4}$,,	$2\frac{3}{4}$,,	$1\frac{3}{4}$,,	280 ,,	8 of 2-ft. lengths.
24-in. ,,	2 ,, $2\frac{1}{2}$,,	$1\frac{7}{8}$,,	3 ,,	$1\frac{7}{8}$,,	373 ,,	6 of 2-ft. lengths.
4-in. cast-iron	9 ft.	$\frac{3}{8}$,,	3 ,,	$\frac{11}{16}$,,	1 cwt. 48 lbs.	14 of 9-ft. lengths.
6-in. ,,	9 ,,	$\frac{7}{16}$,,	$3\frac{1}{2}$,,	$\frac{13}{16}$,,	2 cwt. 56 lbs.	8 of 9-ft. lengths.
9-in. ,,	9 ,,	$\frac{9}{16}$,,	4 ,,	$\frac{13}{16}$,,	4 cwt. 56 lbs.	$4\frac{1}{2}$ of 9-ft. lengths.

Stoneware drain pipes are also made in 3-ft. lengths. They are usually tested to a head of 25 ft. of water, or 11 lbs. per sq. inch.

Fall.

Rule.—Multiply diameter of pipe in inches by 10, and the result will give self-cleansing gradients. Thus:—

Fall of 4-in. pipe should be 1 in 40.
,, 6-in. ,, ,, 1 in 60.
,, 9-in. ,, ,, 1 in 90.
,, 12-in. ,, ,, 1 in 120.

Self-cleansing gradients mean a velocity of 3 ft. per second when the depth of sewage is one-fourth diameter of pipe, which is reckoned as the normal quantity ordinarily passing through domestic drains.

The *maximum* discharge, however, is obtained when the depth of the flow is about $\frac{11}{12}$ths of the diameter of pipe, and not when flowing full, as might be supposed.

Agricultural Drain Pipes.

1,000 of	2-in. pipes,	in 12-in. or	15-in. lengths,	weigh	17 to	19	cwt.
,,	$2\frac{1}{2}$-in. ,,	,,	,,	,,	24 ,,	26	,,
,,	3-in. ,,	,,	,,	,,	34 ,,	36	,,
,,	4-in. ,,	,,	,,	,,	45 ,,	47	,,
,,	6-in. ,,	,,	,,	,,	100 ,,	102	,,

Loading.

2-in. pipes	require	800 to	1,000	per cart load,	and	3,000	per waggon load.
3-in. ,,	,,	400 ,,	500	,,	,,	1,500	,, ,,
4-in. ,,	,,	250 ,,	300	,,	,,	1,100	,, ,,

Number per Acre.

At 12 ft. apart	3,630	of 12-in.	pipes.	At 30 ft. apart	1,452	of 12-in.	pipes.
,, 15 ft. ,,	2,905	,,	,,	,, 33 ft. ,,	1,320	,,	,,
,, 18 ft. ,,	2,420	,,	,,	,, 39 ft. ,,	1,117	,,	,,
,, 21 ft. ,,	2,074	,,	,,	,, 45 ft. ,,	974	,,	,,
,, 24 ft. ,,	1,815	,,	,,	,, 50 ft. ,,	874	,,	,,
,, 27 ft. ,,	1,613	,,	,,	,, 60 ft. ,,	726	,,	,,

PRICES.

Digging for Drains.

Description.	Made Ground.		Common Ground.		Stiff Clay, Gravel, or Loose Chalk.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Excavating trenches for drains, water and gas pipes, with bottoms formed to falls, including filling in and ramming, averaging 2 ft. wide and 1 ft. deep ...per ft. run	0	$1\frac{1}{4}$	0	$1\frac{1}{2}$	0	$1\frac{3}{4}$
Ditto ditto 2 ft. ,, ,, ,,	0	$2\frac{1}{2}$	0	3	0	$3\frac{1}{2}$
Ditto ditto 3 ft. ,, ,, ,,	0	$3\frac{3}{4}$	0	$4\frac{1}{2}$	0	$5\frac{1}{4}$
Ditto ditto 4 ft. ,, ,, ,,	0	6	0	7	0	8
Ditto ditto 5 ft. ,, ,, ,,	0	$7\frac{1}{2}$	0	$8\frac{3}{4}$	0	10
Ditto ditto 6 ft. ,, ,, ,,	0	$10\frac{1}{2}$	1	0	1	$1\frac{1}{2}$

Glazed Stoneware Drain Pipes, &c.

Description.	4-in.		6-in.		9-in.		12-in.		15-in.		18-in.	
	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Plain socketed pipes, in 2-ft. lengths ....per ft. run	0 3½	0 6½	0 5	0 9	0 9	1 3	1 4	2 0	2 4	3 6	3 6	4 8
Bends ....each	0 11½	0 5	1 3	0 6	2 3	0 11	4 2	1 7	7 0	2 8	10 6	4 0
Taper pieces .... ,,	1 2	0 8	1 8	1 0	3 0	1 9	5 6	3 2	9 4	5 4	14 0	8 0
Single junctions .... ,,	1 2	0 8	1 8	1 0	3 0	1 9	5 6	3 2	9 4	5 4	14 0	8 0
Double juuctions .... ,,	1 9	1 0	2 6	1 5	4 6	2 7	8 3	4 9	14 0	8 0	20 8	11 7
Siphon traps, without cleaning eye .... ,,	2 2	2 11	3 3	4 2	6 4	8 2	10 4	12 10	—	—	—	—
Siphon traps, with cleaning eye .... ,,	2 10	3 8	4 0	5 0	7 0	9 0	11 0	13 9	—	—	—	—
Sink or closet traps .... ,,	1 8	2 6	3 4	4 2	6 0	7 0	—	—	—	—	—	—
Traps, square or round, for yards, &c. .... ,,	2 0	3 0	3 0	4 0	5 0	6 6	9 0	11 0	—	—	—	—
Iron gratings for yard gullies, any shape .... ,,	0 9	—	1 0	—	1 6	—	2 0	—	—	—	—	—
Galvanised ditto ditto .... ,,	1 3	—	1 6	—	2 0	—	2 6	—	—	—	—	—
"Beancliff," "Buchan," or similar disconnecting trap .... ,,	8 0	10 0	10 6	12 6	17 6	20 0	—	—	—	—	—	—
Flap traps, with ground surfaces, and galvanised flaps .... ,,	3 4	—	4 2	—	7 0	—	11 8	—	25 0	—	40 0	—
Cutting pipes, bends, taper pieces, junctions, &c., square or splayed, including risk of breakage, labour only..........each cut	0 4	—	0 6	—	0 9	—	1 0	—	1 3	—	1 6	—
White glazed stoneware straight channel-pipes for manholes ....per ft. run	0 8	0 11	0 11	1 2½	1 6	1 10	2 0	2 4	—	—	—	—
Brown glazed ditto ditto ditto...... ,, ,,	0 6	0 9	0 7½	0 11	1 3	1 7	1 9	2 1	—	—	—	—
Bends for last, any sweep ....each	1 10	2 3	2 8	3 2	3 7	4 3	4 6	5 6	—	—	—	—
Cutting square or splayed ends to ditto, including risk of breakage ....each cut	0 6	—	0 9	—	1 0	—	1 3	—	—	—	—	—

Glazed Stoneware Drain Pipes, &c.

Prices are for best quality London make after deducting trade discount, which is 45 per cent. for 4-in. and 6-in. pipes, 40 per cent. for 9-in. pipes, 35 per cent. for 12-in. pipes, and 33 per cent. for 15-in. and 18-in. pipes. "Selected" pipes can be obtained at an increase of 10 per cent., and "selected and tested" at an increase of 25 per cent. above the rates given on p. 95. Midland district prices 5 to 10 per cent. less.

The prices of bends, taper pieces, junctions, &c. in column "Laid and jointed" are *extra only* over the cost of pipes.

Note that bends are 3 times the price of one foot of straight pipe, taper pieces and single junctions 4 times ditto, and double junctions 6 times ditto.

Miscellaneous.

Description.		in. in. 4 to 9		in. in. 12 to 18	
		s.	d.	s.	d.
Ends of drain pipes made good to pipes, down pipes, &c., including cutting and cement	each	0	9	1	6
Opening ground not exceeding 3 ft. deep, breaking up drain for connecting branch of new to old drain and connecting new drain, and making good in cement, fill and ram ground, and make good surface	,,	4	0	6	0
Drain pipes and connections taken up, cleaned, and stacked	per ft. run	0	1	0	2
Gully traps, siphons, &c. ditto ditto	each	1	0	1	6
Testing drains by smoke or scent test	,,	2	9	3	3
Ditto ditto by water test.................	per 10 ft. run	0	10	2	0
Testing ventilating pipes by smoke test	each	3	3	—	
Grease traps, of approved make, supplied only...	,,	10	0	—	
Add if fixed	,,	2	0	—	

Cement concrete bed (1 to 6) under pipes, 12 in. wider than pipes, laid to falls, and flaunched against sides of pipes, with varying thicknesses, as follows :—

					s.	d.
1 ft. 4 in.	wide	by 3 in. thick	for 4-in. pipe ...	... per ft. run	0	6
1 ft. 6 in.	,,	by $3\frac{1}{2}$ in. ,,	,, 6-in. ,, ...	... ,,	0	8
1 ft. 9 in.	,,	by 4 in. ,,	,, 9-in. ,, ...	... ,,	0	11
2 ft. 0 in.	,,	by $4\frac{1}{2}$ in. ,,	,, 12-in. ,, ...	... ,,	1	2
2 ft. 3 in.	,,	by $5\frac{1}{2}$ in. ,,	,, 15-in. ,, ...	... ,,	1	5
2 ft. 6 in.	,,	by 6 in. ,,	,, 18 in. ,, ...	... ,,	1	8

		s.	d.
9 in. by 6 in. Portland cement concrete (1 to 4) surface channel, dished 6 in. wide, and laid to current	per ft. run	1	0
Extra for stopped end	each	0	1
,, ,, external rounded angle	,,	1	0
,, ,, internal mitred angle	,,	1	0
Rendering sides and soffits of manholes with cement and washed sand (1 to 2), ¾ in. thick, trowelled hard and smooth	per yd. sup.	2	6
Ditto, in narrow widths, under 6 in. wide	,,	3	6
Cement angle fillets to manholes and mitres	per ft. run	0	1½
Galvanised cast-iron step irons for manholes, heavy pattern, supplied only	each	2	3
Ditto ditto medium pattern, supplied only	,,	1	4
Jones' patent double air-tight iron covers for manholes, 6 in. deep, 26 in. by 20 in., painted ...	,,	40	0
Ditto ditto galvanised	,,	55	0
Add for setting in cement	,,	3	0
Glazed stoneware gully traps, with galvanised iron gratings, and set in cement, including digging and filling in :—			
6-in. grating with 4-in. outlet	,,	8	0
9-in. ,, ,, 4-in. ,, ...	,,	10	6
9-in. ,, ,, 6-in. ,, ...	,,	14	6
Digging and setting only	,,	2	0
Jennings' stoneware yard gullies, 9½ in. by 9½ in., with 4-in. outlet, s.o.	,,	4	6
Ditto, ditto, 11½ in. by 11½ in., with 6 in. ditto, ditto	,,	7	6
York stone covers for gullies, tooled on top and edges, dished 1 in. deep and 1 in. from edge all round to centre, perforated for gully gratings, and mortised for lugs, 12 in. by 12 in. by 4 in. thick ...	,,	5	0
Add if bedded with cement and set complete ...	,,	0	6
Ditto ditto 15 in. by 15 in. by 4 in. thick	,,	6	0
Add if bedded with cement and set complete ...	,,	0	8
Ditto ditto 18 in. by 18 in. by 4 in. thick	,,	8	0
Add if bedded with cement and set complete ...	,,	0	9
Enamelled cane glazed fireclay kitchen sinks, supplied only, 24 in. by 16 in. by 7 in.	,,	7	6
Ditto ditto 27 in. by 18 in. by 7 in. ...	,,	10	0
Ditto ditto 30 in. by 18 in. by 7 in. ...	,,	11	3
Add to foregoing three items if set in cement ...	,,	3	0
St. George's, Hanover Square, vestry rate for connecting 6-in. drain with sewer, inserting flap-trap and two lengths of pipe (the builder digs and fills in)	,,	15	0
Ditto, ditto, for connecting 9 in. drain with sewer	,,	19	0
Ditto, ditto, ditto 12 in. ditto	,,	26	0
Portland cement	per bushel	1	10
Sand, pit or river, clean sharp, unwashed ...	per yd. cube	6	9
Wages, excavator...	per hour	0	7½
,, general labourer...	,,	0	6½
,, bricklayer	,,	0	10½
,, bricklayer's labourer	,,	0	7

Agricultural Drain Pipes.

Description.	2-in.	3-in.	4-in.	6-in.
	s. d.	s. d.	s. d.	s. d.
Agriculture or unglazed earthenware drain pipes in 12-in. lengths, supplied only......per thousand	35 0	60 0	110 0	210 0
Ditto, laying only......per yd. run	0 0½	0 1	0 1½	0 2½
Ditto, laid complete (exclusive of digging) ....per yd. run	0 2	0 3¾	0 6¼	0 11½

				£ s. d.
Cost of draining land, including pipes and labour, when the agricultural pipes are		6 yds. apart ...	per acre	7 10 0
Ditto	ditto	7 yds. ,, ...	,,	6 10 0
Ditto	ditto	8 yds. ,, ...	,,	5 10 0

Cast-iron Drains.

Description.	4-in.		6-in.	
	Supplied only.	Laid and jointed.	Supplied only.	Laid and jointed.
	s. d.	s. d.	s. d.	s. d.
Cast-iron drain pipes, ⅜ in. metal, treated with Dr. Angus Smith's solution, and caulked with yarn and molten lead ....per ft. run	1 7	2 3	2 4	3 6
Extra for taper or diminishing pipes, all descriptions .... each	3 6	4 9	6 2	8 6
Ditto, ditto, with socket at each end .... ,,	4 2	5 6	7 3	9 9
Ditto, for ordinary bends, ⅜ in. metal, any radius .... ,,	5 4	6 6	10 0	10 9
Ditto, for junctions, ⅜ in. metal, ordinary angles.................... ,,	7 6	8 9	13 6	14 8
Inspection piece with 4-in. ventilating arm, with large shallow socket for cover.................... ,,	9 6	13 6	11 3	17 3
Cast-iron sewer gas trap, ⅜ in. metal, Macfarlane's No. 134 *d.* ,,	22 6	30 6	40 0	51 0
Ditto, ditto, No. 137 *d*, with inspection eye .... ,,	21 3	29 3	40 3	51 3
Mica flap air inlet, ordinary size, of galvanised cast iron and approved make, with brass grating .... ,,	7 6	9 0	13 0	14 9

ANALYSIS.

Drain pipes are measured at per foot run, the digging being best taken separately beforehand. Sometimes the digging, laying and jointing pipes, and filling in and ramming, are all lumped together, the depth of excavation being averaged and stated; but this system only mixes up two different kinds of work.

Joints.

Allow	1	bushel	of neat cement	for	36	joints	for 4-in.	pipes.
,,	1	,,	,,	,,	24	,,	6-in.	,,
,,	1	,,	,,	,,	18	,,	9-in.	,,
,,	1	,,	,,	,,	12	,,	12-in.	,,
,,	1	,,	cement and sand	for	150	ft. run	of 4-in.	pipes.
,,	1	,,	,,	,,	100	,,	6-in.	,,
,,	1	,,	,,	,,	65	,,	9-in.	,,
,,	1	,,	,,	,,	50	,,	12-in.	,,

Labour.

A bricklayer and labourer will lay and joint with cement and sand:—

4-in.	pipes,	100	ft. run	per day	= 1	ft. run in	$\frac{1}{10}$	hour.
6-in.	,,	66	,,	,,	= 1	,,	$\frac{1}{7}$	,,
9-in.	,,	44	,,	,,	= 1	,,	$\frac{1}{5}$	,,
12-in.	,,	33	,,	,,	= 1	,,	$\frac{1}{3}$	,,
15-in.	,,	25	,,	,,	= 1	,,	$\frac{2}{5}$	,,
18-in.	,,	20	,,	,,	= 1	,,	$\frac{1}{2}$	,,
21-in.	,,	17	,,	,,	= 1	,,	$\frac{3}{5}$	,,
24-in.	,,	14	,,	,,	= 1	,,	$\frac{3}{4}$	,,

The valuation can then be easily shown in detail.

4-in. glazed Stoneware Drain Pipes, Laid and Jointed with Cement.—The prices of pipes can be extracted from the table given on previous page. The railway rates are generally for 2-ton lots and upwards. Each length measures 2 ft., exclusive of socket. A bushel of cement will suffice for 36 joints, or $\frac{1}{36}$ bushel per joint.

	s.	*d.*
1 ft. run of 4-in. glazed stoneware pipe at $3\frac{1}{2}d.$	0	$3\frac{1}{2}$
$\frac{1}{36}$ bushel of cement at 1*s.* 10*d.*	0	$0\frac{1}{2}$
$\frac{1}{10}$ hour laying and jointing at 1*s.* 5*d.* (bricklayer $10\frac{1}{2}d.$ and labourer $6\frac{1}{2}d.$)	0	$1\frac{3}{4}$
	0	$5\frac{3}{4}$
Add 15 per cent. profit, &c.	0	$0\frac{3}{4}$
Total price per foot run	0	$6\frac{1}{2}$

When digging is included the width at bottom of trenches should be at least 1 ft. in addition to the diameter of the pipe,

to enable the men to get their hands all round the sockets when jointing; 2 ft. ought, therefore, to be sufficient for pipes from 4-in. to 12-in. diameter. A common and ready method of charging this is to put down 1*d.* per foot run for each foot in depth. The cost of a trench 3 ft. deep may therefore be priced at 3*d.* per foot run, though higher rates are shown under the heading "Digging for Drains" in Prices.

Bends extra only over Cost of Pipes.—These, having been already measured in the straight piping, are now merely valued according to the additional cost of the bend itself over that of a similar length of drain pipe. Allow 2 ft. of drain pipe to equal a bend in length; then extra only for a 4-in. bend would be :—

	s.	d.
Price of 4-in. bend (= 2 ft. of straight pipe)	0	11½
Deduct price of 2 ft. of 4-in. pipe at 3½*d.*	0	7
	0	4½
Add profit	0	0½
Total price	0	5

Taper pieces and single junctions may be taken as equivalent to 2 ft. of pipe, and double junctions to 3 ft. of pipe. These, therefore, are the lengths deducted for "extra only" in laying and jointing.

Siphon Traps, without Cleaning Eye, and set in Cement.—This would be dealt with as below, supposing the trap to equal 2 ft. of pipe. It would probably be set in a manhole.

	s.	d.
4-in. siphon trap, without cleaning eye	2	2
Cement for jointing and setting	0	1
Labour in setting = twice that for 1 ft. of 4-in. pipe	0	3½
	2	6½
Add profit	0	4½
Total price	2	11

Glazed Stoneware Gully Trap, 6-*in. Grating, with* 4-*in. Outlet, and set in Cement, including Digging and Filling in:*—

1 . 6
1 . 6
1 . 3

	s.	d.
—— 2 . 10 = say $\frac{3}{27}$ yard cube digging at 1*s.*	0	1¼
Add for work in small quantities	0	0½
Gully trap, P.C.	6	0
Carried forward	6	1¾

	s.	d.
Brought forward	6	1¾
Cement for fixing	0	1¼
Labour, setting and connecting to drain, ¾ hour bricklayer at 10½*d.*	0	8
	6	11
Add profit, &c.	1	1
Total price	8	0

If a concrete bed is necessary then add.

Ends of Drain Pipes made good to Pits, Down-pipes, &c., including Cutting and Cement, 4-in. to 9-in.—This is only labour and a little cement.

	s.	d.
Labour, ⅔ hour bricklayer at 10½*d.*	0	7
Cement for connecting	0	1
	0	8
Add profit	0	1
Total price	0	9

Agricultural Drain Pipes.

These are measured by the yard run, and for large areas in connection with subsoil drainage by the acre, including material and digging. They are laid dry, without any cementing stuff, and their ends simply abutting. The trenches are very narrow, wider at the top than at the bottom, and cut with special shaped spades, the pipes being laid at various depths and distances apart according to the nature of the subsoil. These data being given, the length of piping and cost of excavation can readily be ascertained. An acre contains 4,840 square yards, or say 69⅔ yards run each way. The labour in laying per lineal yard would vary from ½*d.* for 2-in. pipes to 2½*d.* for 6-in. pipes. Each length is 12 in. or 15 in., and for 12-in. lengths the laying in detail would appear—

	s.	d.
1 yard 2-in. agricultural pipes = $\frac{3}{1000}$ at 35*s.* per thousand ...	0	1¼
Labour in laying ditto	0	0½
	0	1¾
Add profit	0	0¼
Total price per yard run	0	2

If the item includes digging, then the cost of this must also be worked out and added.

CHAPTER VIII.—BRICKLAYER.

MEMORANDA.

Size and Weight of Bricks.

Kind of Brick.	Size.	Weight.	Weight per Thousand.
	in. in. in.	lb.	cwt.
London stock	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	$6\frac{3}{4}$	60
Red kiln	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	7	$62\frac{1}{2}$
Fareham red	$8\frac{1}{2} \times 4\frac{1}{8} \times 2\frac{1}{2}$	6	$53\frac{1}{2}$
Stourbridge firebrick	$9 \times 4\frac{1}{2} \times 2\frac{3}{4}$	$7\frac{3}{4}$	69
Welsh firebrick	$9 \times 4\frac{1}{2} \times 2\frac{3}{4}$	8	71
Staffordshire blue	$9 \times 4\frac{1}{2} \times 3$	10	90
Staffordshire blue, 8 panel, paving	$9 \times 4\frac{1}{2} \times 3$	9	80
Candy's vitrified stable paving	$9 \times 4\frac{1}{2} \times 2\frac{1}{4}$	$6\frac{1}{2}$	58
Dutch clinker	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	$1\frac{1}{2}$	13
Glazed brick	$9 \times 4\frac{1}{2} \times 2\frac{7}{8}$	$7\frac{1}{4}$	65
Coke breeze brick, 1 to 5	$9 \times 4\frac{1}{2} \times 3$	$4\frac{3}{4}$	$42\frac{1}{2}$

Ordinary bricks absorb $\frac{1}{5}$th or $\frac{1}{6}$th of their weight in water after 24 hours' immersion, Blue Staffordshire, or similar bricks, $\frac{1}{15}$th or $\frac{1}{20}$th.

Standard Thickness.

$1\frac{1}{2}$-brick, or $13\frac{1}{2}$ in., is the standard thickness of brickwork. A rod, or square perch, is $16\frac{1}{2}$ ft. × $16\frac{1}{2}$ ft. = $272\frac{1}{4}$ ft. super.

Rule.—To reduce brickwork of any thickness to rods, multiply the superficial content of the wall by the number of half bricks in its thickness, and divide the result by 3, which will give the number of square feet at the standard thickness of $1\frac{1}{2}$ brick. Then divide by 272 (neglecting the quarter foot), the number of feet superficial in a rod, which will give the number of rods of *reduced* brickwork, or brickwork reduced to the standard thickness of $1\frac{1}{2}$ brick.

To reduce cubic feet to the standard thickness, multiply by 8 and divide by 9.

A Rod of Brickwork

= $16\frac{1}{2}$ ft. × $16\frac{1}{2}$ ft. = 272 ft. super. of standard thickness of brickwork.
= $16\frac{1}{2}$ ft. × $16\frac{1}{2}$ ft. × $1\frac{1}{8}$ ft.
= 306 ft. cube.
= $11\frac{1}{3}$ yards cube.
= $30\frac{1}{4}$ yards super. $1\frac{1}{2}$ brick thick.
= $45\frac{1}{3}$ yards super. 1 brick thick.
= 816 ft. super. $\frac{1}{2}$ brick thick.
= 408 ,, 1 ,, ,,
= 272 ,, $1\frac{1}{2}$,, ,,
= 204 ,, 2 ,, ,,
= 163 ,, $2\frac{1}{2}$,, ,,
= 136 ,, 3 ,, ,,
= $6\frac{1}{2}$ roods super. 1 brick thick.
= 4,310 (net quantity) stock bricks laid in mortar, $\frac{1}{4}$-in. joints.
= 4,400 (gross quantity) ,, ,, allowing for waste.
= 5,370 stock bricks laid dry in walls.
= 4,900 ,, ,, in wells.
= 14 tons, about, in weight, when dry.
= 16 ,, ,, ,, when wet.

Other Units.

1 cubic foot of brickwork requires 15 bricks.
1 cubic yard ,, ,, 380 ,,
1 square yard, $1\frac{1}{2}$ brick thick = 144 bricks.
1 rood of reduced brickwork = 63 ft. super. 1 brick thick.

Superficial Measure.

1 ft. super. of	reduced brickwork	requires	16 bricks.
,,	gauged arches	,,	10 ,,
,,	facing (English bond)	,,	8 ,,
,,	facing (Flemish bond)	,,	7 ,,

1 yard super.	$\frac{1}{2}$	brick thick,	$4\frac{1}{2}$ in.,	requires	48 bricks.
,,	1	,,	9 in.	,,	96 ,,
,,	$1\frac{1}{2}$	,,	14 in.	,,	144 ,,
,,	2	,,	18 in.	,,	192 ,,
,,	$2\frac{1}{2}$	,,	23 in.	,,	242 ,,
,,	3	,,	27 in.	,,	290 ,,
,,	$3\frac{1}{2}$	,,	31 in.	,,	306 ,,
,,	4	,,	36 in.	,,	320 ,,.

Brick Facings, &c.

1 yard super. requires 72 bricks and $\frac{1}{4}$ ft. cube mortar, English bond.
,, ,, 64 ,, $\frac{1}{5}$,, ,, Flemish bond.
,, ,, 48 ,, $\frac{3}{4}$,, ,, $\frac{1}{2}$-brick walling.

Brick Nogging.

1 yard super. requires 48 bricks laid flat, and $\frac{3}{4}$ ft. cube of mortar.
,, ,, 32 ,, laid on edge, and $\frac{1}{2}$ ft. cube of mortar.

Brick Paving.

Description.	Size.	No. per yd. super.	Mortar.
	in. in. in.		ft. cube.
Stock bricks laid flat	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	35	1
,, ,, ,, on edge ...	$8\frac{3}{4} \times 4\frac{1}{4} \times 2\frac{3}{4}$	52	$1\frac{1}{4}$
Paving bricks laid flat.........	$9 \times 4\frac{1}{2} \times 2$	32	1
,, ,, ,, on edge ...	$9 \times 4\frac{1}{2} \times 2$	72	2
Dutch clinkers laid flat	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	70	2
,, ,, ,, on edge	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	140	$2\frac{1}{2}$
,, ,, ,, herring-bone flat......................	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	75	2
Dutch clinkers laid herring-bone on edge	$6\frac{1}{4} \times 3 \times 1\frac{1}{2}$	150	$2\frac{1}{2}$
Blue Staffordshire 8 panel paving bricks, bevelled edges	$9 \times 4\frac{1}{2} \times 3$	32	1
Candy's "Olympia" buff vitrified stable paving bricks, with two longitudinal grooves, laid straight	$9 \times 4\frac{1}{2} \times 2\frac{1}{4}$	32	1
Ditto, ditto, laid diagonally	$9 \times 4\frac{1}{2} \times 2\frac{1}{4}$	22 and 13 mitre blocks.	1

Tile Paving.

Shape.	Size.	Thickness.	Weight of each.	Weight per 100.	No. per yd. super.
	in. in.	in.	lbs.	cwt.	
Square	12×12	$1\frac{1}{2}$	13	$11\frac{1}{2}$	9
,, ...	10×10	1	6	$5\frac{1}{2}$	13
,, ...	9×9	1	$5\frac{1}{2}$	5	16
,, ...	6×6	$\frac{7}{8}$	$2\frac{1}{4}$	2	36
,, ...	4×4	$\frac{3}{4}$	$1\frac{1}{8}$	1	81
,, ...	3×3	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	144
Hexagon	6×6	$\frac{7}{8}$	$1\frac{3}{5}$	$1\frac{1}{2}$	36
,, ...	6×6	1	2	2	36
Paving	$9 \times 4\frac{1}{2}$	$1\frac{3}{4}$	5	$4\frac{1}{2}$	32

Weight of Brickwork.

1 ft. cube in lime mortar weighs 112 lbs.
,, in cement mortar weighs 115 lbs.

Stacking.

A stack = 1,000 new bricks closely packed, occupying 50 to 55 ft. cube.
A stack = 1,000 old bricks loosely packed, occupying 65 to 70 ft. cube.

Loading.

A barrow load = 50 bricks.
A cart load = 500 bricks.
A railway truck load = 3,000 bricks.
A load of mortar = 1 yd. cube = 40 hods = 21 bushels = 27 ft. cube.

Bricklayer's Hod.

Size = 16 in. × 9 in. × 9 in.
Capacity for bricks = 20 stock, or 16 walling, or 12 facing; but number ordinarily carried is 12.
Capacity for mortar = $\frac{3}{8}$ ft. cube, or nearly $\frac{1}{2}$ bushel, sufficient to lay 20 bricks.

Clay for Bricks.

An acre of brick earth a foot thick will make a million bricks.
3 yds. cube of strong clay, measured before digging, will make 1,000 bricks.
2 ,, mild ,, ,, ,, ,, ,,
1 yd. cube will therefore make 330 to 500 bricks.
Royalty for obtaining clay varies from 1*s.* to 2*s.* 9*d.* per yd. cube.

Miscellaneous.

1 ft. cube of lime mortar, 1 to 2 = 125 lbs.
18 ,, ,, ,, ,, = 1 ton.
1 ,, cement mortar, 1 to 2 = 130 lbs.
17 ,, ,, ,, = 1 ton.
1 yd. cube of Portland cement = 1 ton.
1 cask of fireclay = 10 cwt.

PRICES.

The following prices apply to every description of brickwork, such as straight, and oblique walls, manholes, tanks, and all similar work, executed to any height, and including labour, plant, scaffolding, supervision, profit, and establishment charges, &c.

Brickwork.

Description.	Per Rod.			Per Yard Cube.			Per Foot Cube.	
	£	*s.*	*d.*	£	*s.*	*d.*	*s.*	*d.*
Stock brickwork, materials and labour, walls 1½ brick or over, in stone lime mortar, 1 to 2	16	9	6	1	9	2	1	1
Ditto, ditto, ditto, 1 to 3	16	7	6	1	9	0	1	1
Ditto, in blue lias or Aberthaw lime mortar	17	0	0	1	10	0	1	1½
Ditto, in neat cement	21	5	0	1	17	6	1	4½
Ditto, in cement mortar 1 to 1	19	2	6	1	14	0	1	3
Ditto, ditto, 1 to 2	18	12	0	1	13	0	1	2½
Ditto, ditto, 1 to 3	18	3	6	1	12	0	1	2½
Ditto, ditto, 1 to 4	17	11	0	1	11	0	1	2

BRICKWORK—*continued.*

Description.	Per Rod.			Per Yard Cube.			Per Foot Cube.	
	£	s.	d.	£	s.	d.	s.	d.
Add if in 1-brick walls	0	11	6	0	1	0	0	0½
Ditto, ½-brick walls	1	3	0	0	2	0	0	1
Ditto, additions or repairs to old work, when the quantity in one building is under 306 ft. cube	—			0	2	0	0	1
Ditto, underpinning walls, when sections are under 75 ft. cube	—			0	3	3	0	1½
Ditto, backing to masonry or terra cotta, including bonding	0	12	0	0	1	1	0	0½
Ditto, chimney shafts, under 20 ft. above roof	—			0	3	3	0	1½
Ditto, brickwork circular on plan, flat sweep, over 15 ft. radius....................	0	12	6	0	1	2	0	0½
Ditto, ditto, quick sweep, under 15 ft. radius	1	5	0	0	2	3	0	1
Ditto, when brickwork is worked fair both sides	0	5	0	0	0	6	0	0¼
Old brickwork in lime mortar, taken down, cleaned and stacked, including scaffolding	3	0	0	0	5	0	0	2
Ditto, in cement mortar, ditto	4	0	0	0	7	0	0	3

FACINGS, &C.

(Extra only to the foregoing Brickwork.)

		s.	d.
Facings of best picked stocks, finished with a neatly-struck weathered joint	per ft. sup.	0	1¼
Ditto, facing stocks, ditto, ditto	,,	0	1¾
Ditto, red kiln-burnt bricks, ditto, ditto	,,	0	2½
Ditto, picked second quality gaults, ditto, ditto ...	,,	0	2
Ditto, white Suffolk bricks, ditto, ditto	,,	0	2½
Ditto, best white Beaulieu, ditto, ditto	,,	0	3
Ditto, best red Fareham, ditto, ditto	,,	0	4½
Ditto, red Cherry, No. 5, pressed, T.L.B., ditto, ditto	,,	0	5½
Ditto, blue Staffordshire bricks, ditto, ditto ...	,,	0	5½
Ditto, first quality white glazed bricks, joints raked out and neatly pointed with Parian cement ...	,,	2	2
Ditto, second quality, ditto, ditto	,,	1	7
Ditto, salt glazed, ditto, ditto...	,,	1	4
Add if in bands not exceeding three courses in height	,,	0	0½
Add if brickwork has battered face	,,	0	0½
Add if brickwork curved on plan, under 50 ft. radius	,,	0	0½
Internal facings of picked stocks, and jointed fair for limewhiting	,,	0	0¾

FACINGS, &c.—*continued.*

		s.	d.
Joints of brickwork struck fair only for inside work, as limewhiting	per yd. sup.	0	3
White glazed tiles, 6 in. by 6 in., 6 in. by 3 in., or 4½ in. by 3 in., as wall lining, including Portland cement ground and pointed with Keen's cement, including hacking face of walls and cuttings ...	,,	11	0
Labour circular cutting to ditto	per ft. run	0	3
Extra to rounded angle	,,	0	3
Brick panel, measured round panel	,,	0	0½

ARCHES.

(Face and soffit to be measured.)

		s.	d.
Extra only on common brickwork for rubbed and gauged arches, in best red rubbers, set in cement and jointed in putty	per ft. sup.	1	10
Ditto, for fair axed arches of kiln-burnt bricks, the ordinary brickwork facings being paid for in addition	,,	0	7
Ditto, for rough axed arches in stocks, including cleaning off soffit and face, and pointing	,,	0	5
Ditto, for fair axed arches in hard red or blue Staffordshire bricks, and ditto	,,	1	0
First quality best selected white glazed brick arches, built in cement and neatly pointed in putty ...	,,	2	4
Second quality, ditto, ditto	,,	1	9
Extra labour, cutting, and waste to relieving arches	each	2	2
Half-brick trimmer arches in cement mortar, including all cuttings, materials, &c., and filling up haunches with concrete	per ft. sup.	0	9

CORNICES.

		s.	d.
Stock brick cornices, including neckings (the quantity being measured as brickwork, and the facings and pointing also in addition, girth measure, materials and labour)	per ft. sup.	0	2
Ditto, with brick dentils, or dog's tooth, set close, flat measure on face, ditto	,,	0	3
Oversail at eaves, one red brick plain course ...	per ft. run	0	1¼
Add for each additional course, ditto	,,	0	1½
Oversail at eaves, red brick rubbed and gauged plain course	,,	0	3½
Add for each additional course, ditto	,,	0	3¾
Oversail at eaves, red brick moulded, rubbed and gauged course	,,	0	5
Add for each additional course, ditto	,,	0	5
Extra on common brickwork for plain moulded course	,,	0	2½
Mitres, external or internal, to plain courses ...	each	0	1
Ditto, ditto, to moulded courses, plain	,,	0	1½
Ditto, ditto, ditto, rubbed and gauged	,,	0	3

Copings.

		s.	d.
Two courses of best Broseley tiles laid in cement, and both edges pointed with cement	per ft. sup.	0	4
Brick on edge coping in cement, flat measure, the brickwork and facings being measured in addition, materials and labour	,,	0	1½
Double chamfered, or double bull-nose, red brick coping, for 1-brick walls, set and jointed in cement	per ft. run	0	8
Plain tile creasing, single, set and jointed in cement	,,	0	9
Ditto, double, ditto	,,	1	3
Stock bridge on edge coping, Broseley double tile creasing, and cement fillets both sides, to 1-brick walls	,,	0	10
Hard red brick, ditto, ditto	,,	1	0
Extra for forming cut mitred angles, intersections, &c., to ditto	each	0	1½
Jennings' improved vitrified glazed stoneware coping, for 1-brick walls, set and jointed in cement ...	per ft. run	1	6
Angles, returns, or stopped ends to ditto	each	5	3
Take off, clear away old coping and double tile creasing to 1-brick walls, and prepare wall for setting new coping	per ft. run	0	2
Broken glass bottling on 1¼ in. thick Portland cement bed to 1-brick walls	,,	0	5

Plinth and Moulded Courses, &c.

Extra only for splayed brick plinth course, stretchers 2¼ in. projection (the cubic quantity being measured as brickwork) and also the facings and pointings in addition	per ft. run	0	3
Extra only for angles to ditto	each	0	4
Extra only for splayed or bull-nose angle, straight (and ditto)	per ft. run	0	2
Stops or mitres to ditto	each	0	3
Extra only for moulded bricks, straight (and ditto)	per ft. sup.	1	0
Stops or mitres to ditto	per inch run	0	1

Damp-proof Courses.

½-in. Val de Travers asphalte damp course	per yd. sup.	3	9
⅝-in. to ¾-in. vertical, ditto	,,	9	0
Callendar's pure bitumen damp course, including lapping	per ft. sup.	0	3
1½-in. vitrified glazed stoneware damp-proof or continuous air course, to suit thickness of walls, and bedded in cement	,,	1	0
3-in. ditto, ditto, ditto	,,	1	3
Extra only for angle blocks for 1½-in. course ...	each	0	8
Ditto, ditto, for 3-in. course	,,	1	0
Slate damp course, double, breaking joint, and laid in cement	per ft. sup.	0	6
Levelling and preparing brick walls for damp course	,,	0	0½
Pointing to edge of slate or asphalte damp course...	per ft. run	0	1½

Brick Nogging.

		s.	d.
Stock brick nogging in lime mortar, laid flat (quarters measured in)	per ft. sup.	0	4½
Ditto, ditto, laid on edge (ditto)	,,	0	3
Ditto, in cement, laid flat (ditto)	,,	0	6
Ditto, ditto, laid on edge (ditto)	,,	0	4

Fire-work.

Setting only grates and stoves, 30 in. to 40 in. wide, materials and labour...	each	5	9
Ditto, self-contained small stoves, ditto	,,	3	0
Ditto, ranges with ovens, boilers, and feed cistern, ditto	,,	10	0
Ditto, kitcheners complete, 40 in. to 60 in. wide, ditto	,,	30	0
Fixing cast-iron, slate, marble, or stone chimney-pieces	,,	2	6
Brickwork to coppers, boilers, ovens, &c., in grey stocks, set with fine mortar, including cuttings and fixing ironwork	per ft. cube	1	4
Flue linings to chimney-shafts, flues, &c., with Stourbridge fire-bricks, 4½ in. thick, set in fireclay ...	per ft. sup.	1	5
Fireclay unglazed flue linings, 1 in. thick, in 12 in. lengths, and 10 in. internal diameter, and setting in fireclay	per ft. run	1	6
Copper coppers	per lb.	1	6
Galvanised iron coppers	per gal.	0	7
Strong cast-iron bottom grates	each	2	9
Strong cast-iron door and frame, wrought fitted ...	,,	5	0

Pointing.

Pointing new work, flat-struck joint in lime mortar	per yd. sup.	1	9½
Ditto, ditto, in coal ash or blue lias	,,	1	11
Ditto, ditto, in cement mortar	,,	2	1
Add to foregoing items if in soffits or arches ...	,,	0	2
Raking and pointing with cement mortar to lead flashings	per ft. run	0	1
Ditto, ditto, to stepped flashings	,,	0	1½
Add if oak wedges are used	,,	0	0¼
Add if lead wedges are used	,,	0	1
Cement filleting, not exceeding 3 in. wide	,,	0	2
Raking out and pointing in cement old brick on edge coping, to 1-brick walls	,,	0	3½
Raking out and pointing joint round frames, with stone lime mortar	per yd. run	0	1½
Ditto, ditto, with coal-ash mortar	,,	0	2
Ditto, ditto, with cement mortar	,,	0	3

Bedding.

Level and prepare old walls to receive new work ...	per ft. sup.	0	1
Bedding door or sash frames in hair mortar ...	per yd. run	0	2

Bedding—*continued.*

		s.	d.
Ditto in hair mortar and pointing with cement ...	per yd. run	0	3
Ditto in cement and pointing with same	,,	0	3½
Bedding and pointing round frames, under 24 ft. super.	each	1	4
Ditto, ditto, 24 ft. to 36 ft. super.	,,	1	8
Bedding window boards in mortar, and pointing round	,,	0	6
Bedding wall-plates in mortar	per ft. run	0	1
Ditto in cement	,,	0	1½
Ditto in pitch and tar	,,	0	1

Cutting and Pinning.

		s.	d.
Rough cutting and waste, straight, for gables, skewbacks, &c.	per ft. sup.	0	1¾
Ditto, circular, over or under arches...	,,	0	2½
Ditto, splays and chamfers, not exceeding 3 in. wide	per ft. run	0	0¾
Ditto, skewback, 5 in. wide	,,	0	2
Ditto, groove for small pipe, or as a raglet	,,	0	1
Ditto, 4½ in. by 4½ in. chase	,,	0	4
Cut for and pin edges of 3-in. landings in cement ...	,,	0	4
Ditto 4-in. ditto	,,	0	5
Ditto 6-in. ditto	,,	0	6½
Fair cutting and rubbing, face work, straight ...	per ft. sup.	0	3¾
Ditto, ditto, circular	,,	0	6
Ditto, splays and chamfers, not exceeding 4½ in. wide	per ft. run	0	1½
Ditto, grooves, rebates, &c., ditto	,,	0	2
Ditto, rounded angles, ditto	,,	0	2
Ditto, stops or mitres to splays, grooves, &c. ...	each	0	1
Ditto, stops or mitres to rounded angles	,,	0	3
Cutting toothings, and bonding new brickwork to old, in lime mortar	per ft. sup.	0	4
Ditto, ditto, in cement	,,	0	5
Cutting through brick walls in lime mortar for doors, windows, &c., and removing and stacking old bricks	per ft. cube	0	4
Ditto in cement mortar, and ditto	,,	0	10
Cutting into brick walls in lime mortar for smoke flues, air channels, and make good in lime mortar	,,	0	11
Ditto, ditto, in cement...	,,	1	2
Cut in brick walls for ends of steps and sills, and pin in cement	each	0	6
Ditto for ends of handrails, brackets, &c., and ditto	,,	0	3
Cutting through brick walls in lime mortar and forming holes to receive ends of timbers, girders, &c., not exceeding 36 sq. in. section, and pin with cement	per in. deep	0	1½
Ditto, in cement mortar, and ditto	,,	0	3½
Add if holes are 36 to 60 sq. in. section	,,	0	0½
Holes cut in brick walls in lime mortar for small pipes, bolts, &c., not exceeding 2 in. diameter, and make good in cement	,,	0	1
Ditto in cement mortar, and ditto	,,	0	1½

Paving.

Description.	Straight. Flat.	Straight. On Edge.	Herring Bone or Diagonal. Flat.	Herring Bone or Diagonal. On Edge.
	s. d.	s. d.	s. d.	s. d.
Hard stock paving bricks, laid and jointed with cement ....per yd. sup.	4 4	6 0	4 6	6 3
Vitrified blue Staffordshire panel paving bricks, with bevelled edges, and ditto .... ,,	6 8	—	—	—
Ditto, square edged, and ditto...... ,,	6 0	8 6	6 3	9 0
Candy's granitic stable paving bricks, and ditto .... ,,	6 8	—	7 0	—
Staffordshire quarries, 6 in. by 6 in., two colours, and ditto .... ,,	6 0	—	6 6	—
Best pressed or tesselated tiles, 6 in. by 6 in., two colours, laid square, and ditto .... ,,	10 0	—	10 6	—
Ditto, 4 in. by 4 in., and ditto...... ,,	11 0	—	11 6	—
Cement and labour only (exclusive of profit) in laying and jointing stock bricks .... ,,	2 7	3 4	2 8	3 5
Ditto, blue Staffordshire .... ,,	2 7	3 4	2 8	3 5
Ditto, Candy's granitic bricks...... ,,	2 7	—	2 8	—
Ditto, 6 in. by 6 in. tiles .... ,,	2 4	—	—	—
Ditto, 4 in. by 4 in. tiles .... ,,	2 9	—	—	—
Take up flat or brick on edge paving, and clearing away .... ,,	0 3	0 4	0 3	0 4
Straight or bevelled cutting, including waste on paving bricks ......per ft. run	0 2	0 3	0 2	0 3
Ditto, on blue Staffordshire......... ,,	0 3	0 4	0 3	0 4
Ditto, on tiles .... ,,	0 2	0 2	0 2	0 2
Forming channels in stock brick paving, including cutting and waste, extra only.................... ,,	0 4	0 6	0 4	0 6
Ditto in blue Staffordshire .... ,,	0 6	0 9	0 6	0 9

		s.	d.
4-in. cement concrete bed, 1 to 5, for laying paving on	per yd. sup.	2	9
6-in. ditto, ditto, ditto	,,	3	9
¾-in. floated cement bed for brick or tile paving ...	,,	1	6
Forming 6-in. gutters in concrete floors	per ft. run	0	3
Ditto 9-in. ditto...	,,	0	5

Miscellaneous.

		s.	d.
Taking down old brickwork in lime mortar, and cleaning and stacking the bricks	per ft. cube	0	1½
Ditto in cement mortar, and ditto	,,	0	2½
Coke breeze concrete lintels, 1 to 5, cast in position	,,	1	7

MISCELLANEOUS—*continued.*

		s.	d.
Weathering top of chimney-shaft with cement ...	per ft. sup.	0	6
Hoop-iron bond, 1¼ in. by $\frac{1}{16}$ in., well tarred, sanded, lapped, riveted, and built into walls	per yd. run	0	2½
Labour only to ditto	,,	0	0½
Forming weep-holes and rendering in cement ...	per ft. run	0	6
Rendering air flues in cement, ½ in. thick	,,	0	5
Plumbing to inside piers	,,	0	2
Pargetting smoke flues with lime and cow dung ...	,,	0	1
Pargetting and coring smoke flues any height ...	each	1	6
Terra cotta chimney-pot, 3 ft. high, and flaunched in cement	,,	5	6
Setting only ditto, and flaunching with cement ...	,,	1	6
Terra cotta air-bricks, 9 in. by 3 in., and built in ...	,,	1	4
Ditto, 9 in. by 6 in., ditto	,,	1	10
Cast-iron air-bricks, 9 in. by 4½ in. by 6 in., ditto...	,,	1	6
Coke breeze concrete bricks, 1 to 5, ditto	,,	0	2
Making good apertures in 2-brick walls for 4-in. drains and pipes	,,	1	0
Building in only Arnott's, Boyle's, or other wall ventilators, and making good...	,,	1	0
,, dampers and frames, and making good in cement	,,	1	6
,, scrapers and ditto	,,	0	9
,, covers and frames for manholes, and ditto...	,,	3	6
,, mangers, including brackets, and ditto	,,	2	0
,, brackets, projecting under 12 in., and ditto	,,	1	0
,, soot doors, and ditto	,,	1	0
,, joists and ironwork for floors, &c.	per cwt.	1	6
Limewashing on walls, &c., 1 coat	per yd. sup.	0	1
Ditto, 2 coats	,,	0	1½

MATERIALS.

(SUPPLIED ONLY.)

Air-bricks, glazed stoneware, or terra cotta, 9 in. by 3 in. on face	per 100	30	0
Air-bricks, glazed stoneware, or terra cotta, 9 in. by 6 in. on face	,,	75	0
Ashes, coal, sifted	per bushel	0	3
,, smith's forge	,,	0	3½
,, for ash mortar, from London railway stations	per ton	4	6
Ballast, Thames	per yd. cube	5	0
Bricks, delivered, sound, hard grey stocks	per 1,000	35	0
,, ,, rough stocks and grizzles	,,	32	0
,, ,, shippers	,,	45	0
,, ,, facing stocks	,,	52	0
,, ,, Flettons	,,	32	0
,, ,, red wire-cuts...	,,	37	0
,, ,, gaults, No. 3, wire-cut	,,	45	0
,, ,, kiln-burnt, red, of uniform colour	,,	60	0

MATERIALS—*continued.*

		s.	d.
Bricks, delivered, best Fareham red	per 1,000	77	0
,, ,, best red pressed Ruabon facing ...	,,	105	0
,, ,, facing, red Cherry No. 5 pressed, T.L.B.	,,	83	0
,, ,, best cutters or rubbers	,,	120	0
,, ,, best vitrified blue Staffordshire ...	,,	90	0
,, ,, ,, ,, ,, ,, bullnose	,,	96	0
,, ,, vitrified blue Staffordshire, 8-panel paving	,,	102	0
,, ,, Candy's buff vitrified stable paving, square	,,	103	0
,, ,, ditto ditto, mitred	,,	113	0
,, ,, best Stourbridge firebricks	,,	95	0
,, ,, best Welsh ,, ...	,,	90	0
,, ,, best Newcastle ,, ...	,,	85	0
,, ,, best white glazed, stretchers ...	,,	260	0
,, ,, ,, ,, headers	,,	240	0
,, ,, ,, ,, quoins, bullnose	,,	340	0
,, ,, ,, ,, double stretchers	,,	380	0
,, ,, ,, ,, double headers...	,,	320	0
,, ,, ,, ,, one side and two ends	,,	380	0
,, ,, ,, ,, two sides and one end	,,	400	0
,, ,, ,, ,, splays, chamfered	,,	400	0
,, ,, for second quality deduct from foregoing	,,	40	0

		s. d.	s. d.
Carting bricks, including loading and unloading, first mile	per 1,000	4 6 to	5 0
Ditto ditto, each mile beyond	,,	1 6 ,,	2 0

		s.	d.
Cement, Portland	per bushel	1	10
,, Roman	,,	1	9
Coke breeze	per yd. cube	3	6
Chimney-pots, terra cotta or stoneware, 3 ft. high, plain	each	3	6
,, ,, ,, 2 ft. high, plain	,,	1	6
Damp course, continuous vitrified glazed stoneware:—			
4½ in. wide by 1 in. thick	per ft. run	0	2¼
9 in. ,, 1 in. ,, ...	,,	0	4½
14 in. ,, 1 in. ,, ...	,,	0	6¾
16 in. ,, 1 in. ,, ...	,,	0	8
18 in. ,, 1 in. ,, ...	,,	0	9
4½ in. ,, 1¾ in. ,, ...	,,	0	3
9 in. ,, 1¾ in. ,, ...	,,	0	5½
14 in. ,, 1¾ in. ,, ...	,,	0	8
16 in. ,, 1¾ in. ,, ...	,,	0	9¼
18 in. ,, 1¾ in. ,, ...	,,	0	10½
9 in. by 9 in. by 1 in. angles	each	0	9
14 in. by 9 in. by 1 in. ,, ...	,,	1	0
9 in. by 9 in. by 1¾ in. ,, ...	,,	1	0
14 in. by 9 in. by 1¾ in. ,, ...	,,	1	4
Fire-clay, Stourbridge, in sacks at railway depôt ...	per ton	27	6
,, ,, ...	per bushel	3	0
Galvanised iron ties, 7 in. long, for hollow walls (247 per cwt.)	per cwt.	31	9

MATERIALS—*continued.*

		s.	d.
Galvanised iron ties, 7 in. long, for hollow walls (7¼ oz. each)	each	0	1½
Hair for mortar or plastering	per cwt.	8	6
Jennings' patent vitrified stoneware bonding bricks for hollow walls, 9 in. long	per 100	16	6
Jennings' improved vitrified glazed stoneware coping for 1-brick walls, stock sizes 14 in. long ...	per ft. run	1	4
Square angles for ditto	each	2	6
Lime, unslaked, ground fine, stone, grey, Dorking	per bushel	0	8¼
,, ,, ,, ,,	per yd. cube of 16 bushels	11	0
,, ,, ,, lias, Lyme Regis	per bushel	0	10
,, ,, ,, ,, ,, ...	per yd. cube	12	6
,, ,, ,, white chalk ...	per bushel	0	7¼
Lime mortar, fine stuff	per ft. cube	0	9½
,, ,, stone lime, white, plain (16*s.* per yd. cube)	,,	0	7
,, ,, ,, ,, hair (18*s.* per yd. cube)	,,	0	8
,, ,, hydraulic lime, plain	,,	0	11
Portland cement mortar, neat	,,	1	11
,, ,, 1 to 1	,,	1	7
,, ,, 1 to 2	,,	1	3
,, ,, 1 to 3 (25*s.* per yd. cube) ...	,,	0	11
Paving tiles, plain, red, square, 12 in. by 12 in. ...	per 100	30	0
,, ,, ,, ,, 10 in. by 10 in. ...	,,	23	0
,, ,, ,, ,, 9 in. by 9 in. ...	,,	20	0
,, ,, ,, ,, 6 in. by 6 in. ...	,,	12	0
,, ,, ,, ,, 4 in. by 4 in. ...	,,	7	0
,, Staffordshire quarries in two colours, 6 in. by 6 in.	,,	8	0
,, best pressed or tesselated, 6 in. by 6 in....	,,	24	0
,, ,, ,, 4 in. by 4 in....	,,	12	0
Rubbish, hard dry, or broken bricks, 2-in. cube, including profit	per yd. cube	3	10
Ditto, hard labour only in breaking into cubes ...	,,	1	4
Sand, from London foundries for black mortar ...	,,	4	0
,, pit or river, clean, sharp, unwashed	,,	6	9
,, ,, ,, ,, washed	,,	10	0
Wall tiles, white glazed, 6 in. by 6 in. by ½ in. ...	per 100	20	0
,, ,, 6 in. by 3 in. by ½ in. ...	,,	12	0
,, ,, 4½ in. by 3 in. by ½ in. ...	,,	9	0
Water, clean, fresh, including delivery under one mile	per ton of 224 gals.	3	6
,, ,, ,, supplied by East London Water Company	per rod of brickwork	1	0
Wages, bricklayer	per hour	0	10½
,, bricklayer's labourer	,,	0	7
,, scaffolder	,,	0	7½
,, carter or driver	,,	0	6½
,, general labourer	,,	0	6½

ANALYSIS.

MORTAR.

Water for Slaking.—The amount of water required for slaking different limes and cements is variable, according to

their freshness. The following may be taken as approximate :—

Description.	Gals. per ft. cube.	Gals. per bushel.
Pure or fat lime	6	$7\frac{1}{2}$
Plymouth stone lime	5	6
Grey chalk lime	4	5
Keynsham lias lime	$2\frac{1}{2}$	3
Lyme Regis lias lime	$1\frac{1}{2}$	2
Roman cement	3	$3\frac{1}{2}$
Portland cement	$1\frac{1}{2}$	2

Shrinkage.—As already pointed out when dealing with concrete, lime and sand, and cement and sand, will shrink when mixed with water and made into mortar. Cement shrinks 10 per cent. when wetted, and sand 20 per cent.; cement and sand in equal proportions 19 per cent. This reduction in bulk for lime and sand when mixed together and wetted may be taken at one-fourth, or 25 per cent.; and for cement and sand at one-sixth, or 17 per cent. Sometimes the diminution in bulk is as much as one-third. It varies, however, according to the freshness of the lime and cement, the coarseness of the sand, the proportions, as well as the amount of water used. A pure lime absorbs more water than one with hydraulic properties, as it evolves greater heat and expands more in slaking; and a recently-burnt lime takes up more water than one that has been allowed to get stale. The quantity generally needed is between one-third and one-half of the bulk of lime, but it is also affected by the sand. Therefore extra quantities of materials, equal to this shrinkage, must be added to produce the stated quantity of mortar.

Amounts of Materials.—The following quantities of materials, in round figures, have been found in practice to make one cubic yard of mortar, allowing for the various shrinkages :—

MATERIALS FOR MORTAR PER YARD CUBE.

Description.	Lime.	Cement.	Sand.	Water.	Labourer.
	Bushels. Ft. Cube.	Bushels. Ft. Cube.	Ft. Cube.	Gals.	Hours.
Lime mortar, 1 to 2 ...	9 = 11	—	23	65	8
„ „ 1 to 3 ...	7 = 9	—	27	50	8
Cement mortar, neat ...	—	24 = 30	—	65	15
„ „ 1 to 1	—	13 = 16	16	52	13
„ „ 1 to 2	—	$8\frac{1}{2}$ = 11	22	40	13
„ „ 1 to 3	—	$6\frac{1}{2}$ = 8	24	37	13
„ „ 1 to 4	—	5 = 6	24	43	11
„ „ 1 to 5	—	4 = 5	25	43	11

Water for concrete, mortar, brickwork, &c., is usually included in the item of "Water for the Works," under the heading of Preliminary and Provisions, but is hereafter shown separately for better analysis.

Lime Mortar.—The calculation for one cubic yard of grey stone lime mortar, 1 to 3 (which is far stronger than the old-fashioned 1 to 2), would then be as below. For water allow 1*d.* per 25 gallons, same rate as for concrete.

	s.	*d.*
7 bushels of stone lime at 8¼*d.*	4	9
27 f.c. = 1 yard cube of sand at 6*s.* 9*d.*	6	9
50 gals. water, at 1*d.* per 25 gals.	0	2
Mixing by hand, 8 hours labourer at 6½*d.*	4	4
Price per yard cube	16	0

The price per foot cube would therefore be 16*s.* ÷ 27 = 7*d.*

Hair Mortar.—Hair mortar is required for bedding and pointing sash and door-frames, filleting, &c., and also for plastering. Plain mortar is that without hair, or coal-ash, &c., being used for ordinary wall building. A bushel of dry hair weighs about 14 lbs., and is classed according to quality, as Nos. 1, 2, and 3, the latter being the best. The usual quantity allowed is 1 lb. of hair to 3 cubic feet of mortar, making 9 lbs. of hair to the yard cube of mortar. The extra cost would be the addition of the hair, and the little further labour needed for its thorough incorporation with the whole mass. Haired stone lime mortar, 1 to 3 :—

	s.	*d.*
7 bushels of stone lime at 8¼*d.*	4	9¾
27 f.c. = 1 yard cube of sand at 6*s.* 9*d.*	6	9
9 lbs. of hair at 8*s.* 6*d.* per cwt.	0	8¼
50 gals. water, at 1*d.* per 25 gals.	0	2
Labour, 10 hours at 6½*d.*	5	5
Price per yard cube...	17	10

Say 18*s.* And price per foot cube, 18*s.* ÷ 27 = 8*d.*

Cement Mortar.—For cement mortar, 1 to 3, a common proportion, the detail would appear :—

	s.	*d.*
6½ bushels of Portland cement at 1*s.* 10*d.*	11	11
24 f.c. = $\frac{24}{27}$ yard cube of sand at 6*s.* 9*d.*	6	0
37 gals. water, at 1*d.* per 25 gals.	0	1½
Labour, 13 hours labourer at 6½*d.*	7	0½
Price per yard cube	25	1

Say 25*s.* Price per foot cube, 25*s.* ÷ 27 = 11*d.*

Machine-made Mortar.—A mortar mill, with 6 ft. pan and 10 H.-P. engine, will turn out per day of 9 hours 13 yards cube of ordinary lime mortar and $6\frac{1}{2}$ yards of hair mortar, actual amount done. Coals $3\frac{1}{2}$ cwt., and one driver and two assistant labourers attending. The mixing only, therefore, costs 1*s.* 4*d.* per yard cube, compared with 4*s.* 4*d.* by hand. Old bricks are frequently crushed with the mortar, which both strengthens and cheapens it. 1 ft. cube of lime mortar, 1 to 2, = 125 lbs., and 18 ft. cube = 1 ton.

Brickwork.

Mortar.—London stocks are $8\frac{3}{4}$ in. × $4\frac{1}{4}$ in. × $2\frac{3}{4}$ in., and the usual specification is that no four courses, including four mortar joints, shall gauge more than 1 in. in addition to the thickness of the bricks themselves. This means $\frac{1}{4}$-in. joints, and gives $20\frac{1}{4}$ cubic inches of mortar per brick. And 4,310 bricks × $20\frac{1}{4}$ cubic inches = 51 ft. cube, or say 2 yards cube of mortar per rod.

With $\frac{3}{8}$-in. joints, half as much more would be required = 77 ft. cube, or say 3 yards cube of mortar per rod.

The above quantities are on the assumption that there is mortar all round each brick, ignoring the facing portions where there is none, and in thin walls there will be less hearting. But the amounts given may be taken as ample averages for any thickness of walling, including waste.

Sometimes the lime, or cement, and sand are inserted as separate items when working out the cost of a rod of brickwork, but it is much simpler and better to work out the price of mortar first of all beforehand, and take 2 or 3 yards cube of it ready made, according as joints are $\frac{1}{4}$ in. or $\frac{3}{8}$ in.

Bricks per Rod.—Now a rod of brickwork = $16\frac{1}{2}$ ft. × $16\frac{1}{2}$ ft. × $1\frac{1}{8}$ ft. ($1\frac{1}{2}$ brick thick) = 306 ft. cube. And 306 less 51 ft. cube of mortar, with $\frac{1}{4}$ in. joints = 255 cubic feet of space occupied by the bricks alone. This divided by the cubic contents of a brick ($8\frac{3}{4}$ in. × $4\frac{1}{4}$ in. × $2\frac{3}{4}$ in. = $102\frac{1}{4}$ cubic inches) gives a result of 4,310 bricks as the net quantity per rod. A small allowance of about 2 per cent. for waste is sufficient, as there are flues, stone, and timber not deducted, and thus we arrive at a total working number of 4,400 bricks per rod.

When the joints are $\frac{3}{8}$ in., the total working number will be 3,950 per rod.

The number of bricks per rod is variously given at 4,300, 4,350, 4,400, 4,450, 4,500, but the foregoing shows the proper methods of calculation.

Delivery of Bricks.—In delivery, few bricks are placed on the job with less than three changes or journeys. First, the haulage from the yard to the barge or railway waggon; second, the canal or railway transit to town nearest the site; third, the cartage from the town to the job itself—in each case including loading and unloading. Water carriage is cheapest by far. Railway rates for bricks are for 4-ton, 5-ton, 6-ton, and 8-ton lots, and the greater the load the cheaper the rate per ton. For instance, for Thomas Lawrence and Son's well-known T.L.B. bricks, the railway rate from Bracknell, Berkshire, to Nine Elms Station, London, is 3*s*. 4*d*. per ton on 4-ton loads, but only 2*s*. 10*d*. per ton on 8-ton loads. The railway rate for bricks from the Midlands to London is 6*s*. 3*d*. for 5-ton lots, and the carriage from Peterborough to London is about 10*s*. per thousand. London stocks weigh 3 tons per thousand.

For loading and unloading a labourer can pick up and throw to a carter standing in a cart 1,200 bricks per hour, when loading close by. This means about 1*s*. per thousand. But if the labourer has to walk three yards to and from the cart and pick up and throw, it will take him twice as long, or 600 bricks loaded per hour. The carter packs the bricks in his cart as he receives them. Loading at Fareham, piecework, costs 4*d*. per thousand. This is managed by the carter and a brickworks labourer, but 1*d*. per thousand is added for every labourer extra who may have to assist if the distance between the stack of bricks and the cart is considerable.

Cartage of bricks costs 4*s*. 6*d*. or 5*s*. per thousand for the first mile, and 1*s*. 6*d*. to 2*s*. per thousand for each mile beyond. A horse and cart will deliver about 1,500 bricks per mile per day; a cart-load = 500 bricks. Haulage by traction engine costs a uniform rate of 1*s*. 6*d*. per thousand per mile.

Price of Bricks.—The brick trade in London seems to be a three-cornered business between the stock brickmakers of Kent and Essex, with an annual output of 400 millions; the Peterborough Fletton manufacturers, also with 400 millions per annum; and the Cowley masters, with 150 millions yearly. Stocks and Flettons are equal in make, and without any real difference in market value. The prices of bricks, like all other building materials, are very fluctuating, and stocks have ranged from 20*s*. to 40*s*. per thousand at the brickfields, and from 30*s*. to 50*s*. per thousand delivered on the site. For the new Government Offices now being erected

in Parliament Street, London, 25 millions of Flettons are required, and the price is under 27*s.* per thousand *delivered on the site;* this must mean the extraordinary low rate of about 10*s.* per thousand into trucks at the brickyard.

Taking the price of hard grey stocks at 30*s.* per thousand alongside in the Thames, and adding 5*s.* for cartage, give 35*s.* delivered on the site—a somewhat low, but not unusual valuation. To allow for variation in the price of bricks, the cost per rod will vary 4*s.* 5*d.* (4,400 per rod) for every shilling of variation in the price per thousand of the bricks; for this, 5*s.* per rod is assumed to be sufficiently exact, as that includes profit.

Water.—Bricks absorb about $\frac{1}{5}$th or $\frac{1}{6}$th of their weight in water after 24 hours' immersion. This is equivalent to practically 1 pint per brick for absorption (1 gallon = 10 lbs., 8 pints = 1 gallon, and 1 pint = $1\frac{1}{4}$ lb.), which is a ready guide for wetting allowance for bricks prior to laying. As there are 4,400 bricks per rod, these will take up 4,400 pints of water, if the specification stipulates that the bricks shall be placed to soak in a tub for some time before setting. Now 4,400 pints ÷ 8 pints per gallon = 550 gallons of water required per rod of brickwork. If, however, the bricks are only to be sprinkled from a hose or a bucket, it is impossible to say how much water is likely to be used. An allowance of 125 to 200 gallons has been stated, but this is really for making the mortar (2 to 3 yards cube per rod). The East London Water Company charges 1*s.* for water per rod of brickwork. Although water is taken under the heading of "Water for the Works," it is shown separately in brickwork for the sake of better analysis.

Labour per Rod.—It was formerly considered that in foundations and walls where the joints were left rough, a bricklayer, supplied with materials by his labourer, could lay 1,500 bricks per day, as, owing to the mass of the work, he could pack them in with both hands. In boundary and other walls where both faces have to be worked fair, not more than 1,000; and if they were carefully jointed and faced with picked bricks of a uniform colour, not more than 500 per diem, and then only in straight walling without many openings. The time spent is less for thick walls, and greater for thin ones.

A bricklayer and his labourer can still lay the above number if they choose, or, say, for all ordinary purposes, 2 yards cube per day, comprising 760 bricks, but frequently not more than $1\frac{1}{2}$ yards cube, or 570 bricks, are reckoned.

It is even estimated by experienced builders that a bricklayer nowadays only lays 500 inside and 300 facing bricks per day, which would be an average of 400 bricks over all the walling. As there are 380 bricks in a cubic yard, this would be, roughly, a cubic yard of brickwork per man per day. In London, 450 bricks per day is considered a fair standard, and the unwritten trade union limit is supposed to be 400. The London County Council limit has been stated to be as low as 330 bricks per day. It is, therefore, most perplexing to put down any reliable data for labour, but if 630 bricks are taken (which *ought* to be done with good supervision), this would give 4,400 bricks per rod ÷ 630 bricks = 7 days of bricklayer and his labourer per rod for ordinary 1½-brick walling. More labour will be required if the brickwork is in cement mortar, and also if walls are 1 brick or ½ brick thick.

For hodsmen or bricklayers' labourers, on ground floor allow 1 hodsman to 2 bricklayers (= ½ hodsman to 1 bricklayer); on upper floors, where hodsmen have to ascend and descend ladders, allow 1 hodsman to 1 bricklayer; and on chimneys, involving long up and down climbing, allow 2 hodsmen to 1 bricklayer. This averages 1 hodsman to 1 bricklayer. For large buildings it does not pay for bricklayers to be served by the old-fashioned system of hod-carriers, but by labour-saving appliances such as barrow hoists, raising 20,000 bricks per hour, by improved scaffolding and platform lifts, one ascending while the other descends (one of these platforms can be raised from the ground at the rate of 10 ft. per second), by mortar mills, concrete mixers, and such like machines. By supplanting hodsmen by capstans and cranes, as much as £50 per day can be saved in the labour bill on extensive works. Big trowels, such as those used in the Manchester district, and thinner mortar, likewise assist the progress, as the bricks are laid by a light pressure of the hand and a touch of the trowel, instead of by repeated hammering of the latter to force the brick into place in stiff mortar. By the use of soft mortar enough can be laid with one stretch of a large trowel for perhaps a dozen bricks. These up-to-date methods were adopted in the erection of the Westinghouse buildings at Manchester, in 1901, with the result that on common work the average was over 2,000 bricks laid per man per day. *Verb. sap.*

Scaffolding.—For the use of scaffolding, erection, and removal, 6*s.* per rod may be charged. As a scaffolder gets

$7\frac{1}{2}d.$ per hour, this represents the erection, and removal on completion, of sufficient scaffolding for one rod in a day.

DETAIL PER ROD.

Brickwork in Lime Mortar, 1 *to* 3.—The analysis of a rod of stock brickwork, standard thickness, in grey stone lime mortar, 1 to 3, with $\frac{1}{4}$-in. joints, would then be :—

	£	s.	d.
4,400 stocks at 35*s.* per 1,000 delivered	7	14	0
Water, for wetting bricks only, East London Water Company's charge	0	1	0
2 yds. cube lime mortar, 1 to 3, at 16*s.*	1	12	0
Labour building, 7 days bricklayer and labourer at 13*s.* $1\frac{1}{2}d.$ ($10\frac{1}{2}d. + 7d. = 17\frac{1}{2}d. \times 9$ hrs.)	4	11	$10\frac{1}{2}$
Use of scaffolding, erection, and removal	0	6	0
	14	4	$10\frac{1}{2}$
Add 15 per cent. profit, &c.	2	2	$7\frac{1}{2}$
Total price per rod	16	7	6

The price per yard cube can easily be deduced from the foregoing by dividing £16 7*s.* 6*d.* by $11\frac{1}{3}$, the number of cubic yards per rod, which gives :—

£16 7*s.* 6*d.* $\div$ $11\frac{1}{3}$ = £1 9*s.* 0*d.* per yard cube.

Similarly, the price per foot cube, by dividing the same sum by 306, the number of cubic feet per rod :—

£16 7*s.* 6*d.* $\div$ 306 = 1*s.* 1*d.* per foot cube.

The price per yard cube and per foot cube can, however, be detailed separately, with proportionate reduction in materials and labour, but the larger the standard taken the less waste, and the closer will be the investigation.

Brickwork in Cement Mortar, 1 *to* 3.—For stock brickwork in cement mortar, 1 to 3, standard thickness, with $\frac{1}{4}$-in. joints as before, the valuation would be in like manner. There will now be more labour, as cement works shorter.

	£	s.	d.
4,400 stocks at 35*s.* per 1,000 delivered	7	14	0
Water, for wetting bricks only, East London Water Company's charge	0	1	0
2 yds. cube cement mortar, 1 to 3, at 25*s.*	2	10	0
Labour building, 8 days bricklayer and labourer at 13*s.* $1\frac{1}{2}d.$...	5	5	0
Use of scaffolding, erection and removal	0	6	0
	15	16	0
Add 15 per cent. profit, &c.	2	7	6
Total price per rod	18	3	6

Price per yard cube would be £18 3*s.* 6*d.* $\div$ $11\frac{1}{3}$ = £1 12*s.* 0*d.*
And price per foot cube would be £18 3*s.* 6*d.* $\div$ 306 = 1*s.* $2\frac{1}{2}d.$

When brickwork is billed "extra only in cement," the price can readily be obtained by deducting the price of a rod of brickwork in mortar from a rod in cement.

With these examples and memoranda before him, the estimator should be able to work out for himself other items where the proportions of lime or cement and sand are different, and where there may be another size of brick.

Hollow Walls.—These are taken as solid, the $2\frac{1}{4}$ in. cavity being measured in the thickness. The ties should be inserted at every 3 or 4 bricks in length and every 3 or 4 courses in height, or, say, about 2 ft. 6 in. horizontally and 1 ft. vertically, placed chequerwise. More should be provided for the angles and piers of buildings, to make them stronger. This would give an average of 4 per yard super., or 120 per rod (272 ft. super. ÷ 9 ft. × 4). The ties may be either Jennings' patent vitrified stoneware bonding bricks at 16*s.* 6*d.* per 100 if 9 in. long, or 7 in. galvanised-iron ties weighing 247 to the cwt. at 31*s.* 9*d.* per cwt., or $1\frac{1}{2}$*d.* each. Allow for hay-bands or wooden fillets to prevent the mortar from dropping into the hollow space—about 10*s.* per rod. For brickwork in lime mortar in hollow walls therefore—

	£	s.	d.
Materials and labour per rod as before, prime cost	14	4	$10\frac{1}{2}$
120 Jennings' 9-in. bonding bricks at 16*s.* 6*d.* per 100 ...	0	19	$9\frac{1}{2}$
Hay-bands and shifting	0	10	0
	15	14	8
Deduct $\frac{1}{6}$th of £14 4*s.* $10\frac{1}{2}$*d.* for $2\frac{1}{4}$ in. cavity (measured in with the brickwork)	2	7	6
	13	7	2
Add 15 per cent. profit, &c.	2	0	1
Total price per rod	15	7	3

There is thus an apparent reduction of £1 per rod over solid walls, owing to the saving of brickwork in the cavity more than compensating for the ties and hay-bands. But as a little more labour would be required in building two skins of brickwork instead of a solid wall, the price is usually reckoned the same.

Add if in Backing to Masonry.—This necessitates more labour and more rough cutting than ordinary brick walling. For the former, allow an additional half day of bricklayer and labourer. For the latter, take $\frac{1}{4}$ brick wasted per ft. super., and as there are 8 bricks per ft. super. facing English

bond, this gives 272 ft. super. rod × 8 bricks per ft. super. × ¼ brick wasted = say, 500 bricks wasted per rod.

	s.	d.
Additional labour, ½ day bricklayer and labourer at 13*s.* 1½*d.* ...	6	7
Bricks wasted, 500 at 35*s.* per 1,000	4	0
	10	7
Add 15 per cent. profit, &c.	1	5
Total price per rod	12	0

Price per yard cube 12*s.* ÷ 11⅓ = 1*s.* 1*d.*
Price per foot cube 12*s.* ÷ 306 = ½*d.*

Add if in Circular Brickwork.—If quick sweep, or under 15 ft. radius, there will be 1½ days additional labour per rod, and about 5 per cent. waste for the cutting required throughout the thickness of the wall.

	£	s.	d.
Additional labour, 1½ days bricklayer and labourer at 13*s.* 1½*d.*	0	19	8
Bricks wasted, 5 per cent. on 4,400 = say, 250 bricks at 35*s.* per 1,000	0	2	0
	1	1	8
Add 15 per cent. profit, &c.	0	3	4
Total price per rod	1	5	0

Price per yard cube £1 5*s.* ÷ 11⅓ = 2*s.* 3*d.*
Price per foot cube £1 5*s.* ÷ 306 = 1*d.*

Flat sweep, or over 15 ft. radius, would be half the above rates.

Facings.

Facings of best picked Stocks, finished with a neatly struck Weathered Joint.—There are 272 ft. super. in a rod, and as 7 bricks go to the square foot, this gives 2,000 facing bricks per rod, with allowance for waste. For picking, a labourer will take 3½ hours to select 1,000 bricks, or 7 hours to select the 2,000 facing bricks requisite per rod. A bricklayer will occupy a day in striking the joints for the 1,000 bricks, or 2 days in striking the 2,000 facing bricks necessary per rod.

	s.	d.
Selecting 2,000 facing bricks for a rod, 7 hours labourer at 7*d.*...	4	1
Material for jointing, say 5 ft. cube lime mortar at 7*d.*	2	11
Striking joints for ditto, 2 days or 18 hours bricklayer at 10½*d.*...	15	9
Carried forward	22	9

	s.	d.
Brought forward	22	9
Add 15 per cent. profit, &c.	3	5
Price per rod of 272 ft. super. ... ... 272)	26	2
Price per foot super.	0	$1\frac{1}{4}$

If *facing* instead of "picked" stocks are specified the selecting would be eliminated, but the excess cost of facing (about 17*s.* per thousand) over ordinary stocks would have to be added, making the price $1\frac{3}{4}$*d.* per ft. super.

Facings of Red Cherry No. 5 pressed, T.L.B., finished with a neatly struck Weathered Joint.—Here there is extra for superior bricks, and Thomas Lawrence and Son's Bracknell Red Cherry No. 5 pressed facings cost 77*s.* per thousand in 8-ton lots at Nine Elms, or say 83*s.* delivered on site.

	£	s.	d.
Cost of Cherry facing bricks per 1,000	4	3	0
Deduct cost of stocks per 1,000	1	15	0
Difference per 1,000	2	8	0

And as there are 7 facing bricks per foot super., 272 × 7 = 1,900 per rod, we now proceed :—

	£	s.	d.
Cost of 1,900 bricks, extra only at difference of £2 8*s.* per 1,000	4	11	3
Material for jointing, say 5 ft. cube lime mortar at 7*d.* ...	0	2	11
Striking joints, 2 days or 18 hours bricklayer at $10\frac{1}{2}$*d.* ...	0	15	9
	5	9	11
Add 15 per cent. profit, &c.	0	16	6
Price of 272 ft. super. ... ... 272)	6	6	5
Price per foot super.	0	0	$5\frac{1}{2}$

Joints of Brickwork struck fair only for Inside Work, as Limewhiting.—This is merely labour, and can be done as the work proceeds. A bricklayer could do 40 yards per day, or, say, 1 yard in a quarter of an hour.

	s.	d.
$\frac{1}{4}$ hour bricklayer at $10\frac{1}{2}$*d.*	0	$2\frac{3}{4}$
Add profit	0	$0\frac{1}{4}$
Price per yard super.	0	3

Arches.

Extra only on common Brickwork for rubbed and gauged Arches in best red Rubbers, set in Cement and jointed in Putty.—This is really extra on the facing bricks, which have been

already taken. One foot super. of gauged arch requires 10 bricks, including waste, as against 7 bricks for facings.

	s.	d.
Cost of 10 rubbers at 120*s.* per 1,000	1	2½
Deduct cost of 7 facing bricks, extra only over stocks	0	4
	0	10½
Cement and lime-putty for setting and jointing	0	1
Labour in cutting, rubbing, and setting, ¾ hour bricklayer at 10½*d.*	0	8
	1	7½
Add profit	0	2½
Price per foot super.	1	10

Ditto for rough axed Arches in Stocks, cleaning and pointing.—No special facing bricks are required, and it is merely a matter of cutting and setting. A bricklayer can turn and set in mortar, including picking bricks, a 9-in. arch, 4½ in. thick, comprising 15 stocks, over a 3 ft. 6 in. opening in an hour = 1 ft. super. in ⅓ hour.

	s.	d.
Mortar for pointing	0	0½
Axing and setting, ⅓ hour bricklayer at 10½*d.*	0	3½
Cleaning off and pointing	0	0½
	0	4½
Add profit	0	0½
Price per foot super.	0	5

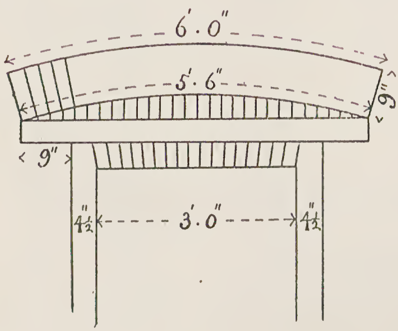

Fig. 1.

Extra Labour, Cutting, and Waste to Relieving Arches.—These are generally simply numbered, stating the size. The internal appearance of a 3 ft. opening, with a wooden lintel,

would be as in Fig. 1, with dimensions as shown. The arch is one brick deep by one brick wide (width of jamb). The rough-cutting is the girth by width of arch, which gives the axing required on the adjacent brickwork. This axing is the extra labour involved, for there is no additional trouble in building the arch itself, which has been included in the ordinary walling.

	s.	d.
6 . 0 extrados.		
5 . 6 intrados.		
11 . 6 girth × . 9, width of arch = $8\frac{1}{2}$ ft. super. circular rough cutting and waste at $2\frac{1}{2}d.$ ...	1	$9\frac{1}{4}$
. 9 skewback.		
. 9 skewback.		
1 . 6 length × . 9 width of arch = 1 ft. super. straight rough cutting and waste at $1\frac{3}{4}d.$ ...	0	$1\frac{3}{4}$
	1	11
Add profit ...	0	3
Total of each...	2	2

Sometimes the rough-cutting to skewbacks is taken separately.

Half-brick Trimmer Arch in Cement Mortar, including all Cuttings, Materials, &c.—There will be extra labour in building the arch, as it is in $\frac{1}{2}$-brick thickness and in small quantities. The haunches will be levelled up with concrete to take the hearth above.

	£	s.	d.
Price of rod of brickwork in cement mortar, 1 to 3 ...	18	3	6
$\frac{£18\ 3s.\ 6d.}{272}$ = price of brickwork per foot super., $1\frac{1}{2}$ brick thick	0	1	4
$\frac{1s.\ 4d.}{3}$ = price of ditto $\frac{1}{2}$ brick thick ...	0	0	$5\frac{1}{4}$
Extra labour for $\frac{1}{2}$ brick thick and in small quantities ...	0	0	2
Levelling up with concrete in small quantities ...	0	0	$1\frac{3}{4}$
Price per foot super. ...	0	0	9

It will be observed that the above includes profit throughout.

Moulded Course.

Extra on Common Brickwork for Moulded Course.—This is one course of red moulded brick, measured extra only to

common brickwork, and the cubical contents of which have already been taken in the latter. If header and stretcher be used alternately, allow two bricks per foot run. The number will be a trifle less, as one header and one stretcher, with two joints, would measure $13\frac{1}{2}$ in., but this extra length would allow for waste.

	s.	d.
1,000 red moulded bricks at 90s.	90	0
Deduct cost of 1,000 stocks at 35s.	35	0
Difference	55	0
Therefore the cost, extra only, would show thus:—		
2 bricks at 55s. per 1,000	0	$1\frac{1}{4}$
Extra cement	0	$0\frac{1}{4}$
Extra labour in setting and pointing	0	$0\frac{3}{4}$
	0	$2\frac{1}{4}$
Add profit	0	$0\frac{1}{4}$
Price per foot run	0	$2\frac{1}{2}$

Mitres to ditto.—The mitred bricks cost double the price of the moulded ones, and the detail would be worked out similarly.

	s.	d.
1,000 mitred bricks at 180s....	180	0
Deduct cost of 1,000 moulded bricks at 90s.	90	0
Difference	90	0
1 mitred brick at 90s. per 1,000	0	1
Add profit and extra setting	0	$0\frac{1}{2}$
Price per mitre	0	$1\frac{1}{2}$

All the labour and setting have already been included in the lineal dimension of the moulded course, as it is on this that the mitres are extra.

Damp-proof Courses.

Damp-proof Course of two Layers of stout Slates, breaking joint, and laid in Portland Cement.—Countess or Duchess slates are generally used, and second quality are the best for this class of work, as they are thicker and cheaper. Slates are sold by the thousand of 1,200 delivered, and the area of a Countess slate would be 20 in. × 10 in. = $1\frac{1}{3}$ ft. super.; but allow one slate to the square foot, reckoning for waste in cutting to suit thickness of wall. And as there are two

layers, there would be thus two slates per foot superficial for the damp course. An inferior, but good enough, sort for this purpose, could be got for £9 per 1,200.

	s.	d.
2 slates at £9 per 1,200 delivered	0	$3\frac{1}{2}$
Cement for bedding	0	1
Labour cutting and laying	0	$0\frac{3}{4}$
	0	$5\frac{1}{4}$
Add profit	0	$0\frac{3}{4}$
Price per foot super.	0	6

Fire-work.

Setting only Grates and Stoves, 30 *in. to* 40 *in. wide.*—A bricklayer and labourer would take from two to three hours to set an ordinary grate, and some stock brickwork would probably be required for the backing, as well as fireclay for the fire-lumps.

	s.	d.
$2\frac{1}{2}$ hours bricklayer ($10\frac{1}{2}d.$) and labourer (7*d.*) at 1*s.* $5\frac{1}{2}d.$ ...	3	8
Brickwork and fireclay, say, 1 ft. cube	1	4
	5	0
Add profit	0	9
Price of each	5	9

Ranges and kitcheners would cost a great deal more, depending upon the type of apparatus and the size of the opening.

Pointing.

Pointing new Work, flat-struck Joint in Lime Mortar.—This includes raking out joints, &c. A cubic yard of lime mortar will point 170 sq. yds. of walling, or $\frac{1}{6}$ ft. cube per yard super. A bricklayer and labourer will do 9 to 11 yards super. per day, or say 1 yard super. per hour.

	s.	d.
$\frac{1}{6}$ ft. cube lime mortar at 7*d.*...	0	$1\frac{1}{4}$
Labour, 1 hour bricklayer and labourer at 1*s.* $5\frac{1}{2}d.$	1	$5\frac{1}{2}$
	1	$6\frac{3}{4}$
Add profit	0	$2\frac{3}{4}$
Price per yard super.	1	$9\frac{1}{2}$

Pointing is best given out as piecework, which urges the men to execute as much as possible. A bricklayer who

makes pointing a speciality is called a "wigger" in some parts, and will point, including raking out joints and providing his own stuff, but not scaffolding, at a contract rate of 7*d.* per yard super., with wages at 9*d.* per hour. This is about 1¼ yard per hour. The amount of work done is ascertained on completion per day, the walling being measured flat, without additions or deductions for doors or windows, the extra labour for reveals and soffits being thus allowed for in the areas for openings not deducted.

Raking out old mortar joints, colouring, and flat-joint pointing has been sublet in London at 8*s.* per 100 ft. super. for material and labour = 1*d.* per ft. super. = 9*d.* per yard super.

Ditto in Cement Mortar.—Raking out joints also included. A cubic yard of cement mortar, 1 to 2, will point 225 sq. yds. of walling, or ⅛ ft. cube per yard super. A bricklayer and labourer will do about 8 yards super. per day, or say 1 yard super. in 1⅛ hour.

	s.	*d.*
⅛ ft. cube cement mortar, 1 to 2, at 1*s.* 3*d.*	0	2
Labour, 1⅛ hour bricklayer and labourer at 1*s.* 5½*d.*	1	7¾
	1	9¾
Add profit	0	3¼
Price per yard super.	2	1

In summer, pointing to brickwork may be done as the work proceeds, but in winter it should not be executed till the last, when the walls are finished, that is, done downwards as the scaffolding is being removed, in case of frost breaking it off.

Tuck Pointing.—For material allow ⅛ ft. cube mortar and ⅛ ft. cube lime-putty per yard super., and rather more than double the foregoing labour.

Pointing Old Work.—If the pointing is to old work, a scaffold would have to be erected and removed, and there would also be some further time for raking out old joints, cleaning and rubbing down, &c., as compared with that in new work—about double the labour altogether.

Raking and pointing with Cement Mortar to Lead Flashings.—The raking out is done by a labourer, who will do 100 ft. run in 4 hours, and the pointing by a bricklayer, who will execute 100 ft. in 6 hours. ½ ft. cube of cement mortar, 1 to 2, will point this length.

	s.	d.
Labourer raking out, 4 hours at 7*d.*	2	4
Bricklayer pointing, 6 hours at 10½*d.*	5	3
Cement mortar, 1 to 2, ½ ft. cube at 1*s.* 3*d.*	0	7½
	8	2½
Add 15 per cent. profit	1	3
Price of 100 ft. run ... ... 100)	9	5½
Price per foot run	0	1

If oak wedges are used add ¼*d.* to price per ft. run, and if lead wedges, 1*d.* The latter weigh about 2½ ozs. each, and are spaced about every 18 in. apart in straight flashings, and at every step in stepped flashing.

Ditto to Stepped Flashings.—This is measured on rake in the quantities, but for labour and material the girth of the joint steps would be about 1½ time the length of the straight raking line. Consequently the price may be taken as 1½ time the last, that is, 1½*d.* per ft. run.

Cement Filleting.—A bricklayer and labourer will run 12 ft. per hour of 2½ in. by ¾ in. cement filleting under slating to gables, using guiding laths. Cement required, ⅛ bushel per 12 ft. run.

	s.	d.
1 hour bricklayer and labourer	1	5½
⅛ bushel cement at 1*s.* 10*d.*	0	2½
	1	8
Add profit	0	3
Price of 12 ft. run ... ... 12)	1	11
Price per foot run	0	2

Bedding.

Bedding Frames in Hair Mortar, and Pointing with Cement.—This implies that the portion of the frame which abuts against the inner reveal is bedded in a narrow band of hair mortar, and that the exposed edge is pointed all round with cement after fixing the frame. As a window frame for a 3 ft. × 6 ft. opening would be 21 ft. girth, the area of bedding would be 21 ft. by 4½ in. = about 8 ft. super., and require, say, ½ ft. cube of mortar. Labour would be about ¾ hour bricklayer and labourer.

	s.	d.
½ ft. cube hair mortar for screeding, at 8*d*.	0	4
Cement for pointing all round	0	1¼
¾ hour bricklayer and labourer at 1*s*. 5½*d*.	1	1
	1	6¼
Add profit	0	2¾
Price of 21 ft. or 7 yds. run	7)1	9
Price per yard run	0	3

Price 1*s*. 9*d*. per frame, the item being sometimes thus billed.

Bedding Wall-plates in Mortar.—A bricklayer, with attendant labourer, will bed about 24 ft. run of 4½ in. × 3 in. wall-plate per hour. Area of bedding will be 24 ft. × 4½ in. = 9 ft. super., requiring, say, ½ ft. cube of ordinary mortar.

	s.	d.
½ ft. cube of mortar at 7*d*.	0	3½
1 hour bricklayer and labourer	1	5½
	1	9
Add profit	0	3
Price of 24 ft. run	24)2	0
Price per foot run	0	1

Cutting and Pinning.

Rough Cutting and Waste, straight.—This is for such parts as gables, skewbacks, &c. The waste is usually small, and is mainly taken into consideration in the number of bricks allowed per rod of brickwork.

	s.	d.
Waste in cutting, say	0	0½
Labour in cutting, $\frac{1}{10}$ hour bricklayer at 10½*d*.	0	1
	0	1½
Add profit	0	0¼
Price per foot super.	0	1¾

Fair Cutting and Rubbing, straight.—Here more labour is entailed than in last, while the waste is the same.

	s.	d.
Waste in cutting, say	0	0½
Labour in cutting and rubbing, ¼ hour bricklayer at 10½*d*. ...	0	2¾
	0	3¼
Add profit	0	0½
Price per foot super.	0	3¾

Rough Cutting, Skewback, 5 in. wide.—This is cut after the work is built, and generally refers to trimmer arches. The skewback is 4½ in. wide, but is measured as 5 in. The labour would be one-fifth hour of bricklayer at 10½*d.* = 2*d.* per foot run.

Cutting Groove.—A bricklayer will cut about 12 ft. run in an hour of grooving, 1 in. deep, in brickwork for small pipe, or as a raglet.

	s.	d.
1 hour bricklayer	0	10½
Add profit	0	1½
Price of 12 ft. run	12)1	0
Price per foot run	0	1

Rough Cutting for 4½-in. by 4½-in. Chase.—This will probably apply to cutting a chase for a soil-pipe; but this is generally left as the work is carried up and is half a brick each way; there would thus be little need to price it. But if the pipe is small, the chase would most likely be cut afterwards, and would only mean a few minutes' labour with hammer and chisel, being estimated at about 4*d.* per foot run, including profit.

Cut for, and Pin Edges of, Landings in Cement.—If these have not already been built in with the work, as they should be, the brickwork will have to be cut away for them. For a 3-in. landing one course of bricks will have to be removed, and above this to 6 in. two courses. The lineal space above and below will then have to be made good, and the edges of stone pointed with cement; the mason will fix the landing. For a 6-in. landing (cutting out two courses) the detail would appear :—

	s.	d.
Bricklayer, ½ hour at 10½*d.*	0	5¼
Cement for making good and pointing	0	0½
	0	5¾
Add profit	0	0¾
Price per foot run	0	6½

For a 3-in. landing (cutting out one course), take half the foregoing labour, making 4*d.* per foot run for the whole cost. Add 1*d.* per foot run for every inch of increased thickness of landing.

Cutting Toothings and Bonding New Brickwork to Old, in Lime Mortar.—One course in every four of the new brick-

work would be toothed 4½ in. into the old, which would be cut out to receive the projection. The remaining three courses would make a straight joint. The cost of the extra materials should be included with the labour. For 1½-brick wall the detail would be :—

	s.	d.
Extra brickwork, 14 in. by 3 in. by 4½ in. projection	0	1
Extra lime mortar for toothing	0	0½
Labour, ⅕ hour bricklayer at 10½*d.*	0	2
	0	3½
Add profit	0	0½
Price per foot super.	0	4

If the toothings are in cement add 1*d.* to foregoing rate.

Cut for Ends of Steps, and Pin in Cement.—An item of this sort is on the assumption that, owing to the great trouble and accuracy required in making provision beforehand, the holes for steps, &c., are cut away, probably to a depth of 4½ in., and made good after the brickwork is up. A bricklayer and labourer would be occupied about a quarter of an hour over each one.

	s.	d.
Labour, ¼ hour bricklayer and labourer at 1*s.* 5½*d.*	0	4
Cement for pinning	0	1¼
	0	5¼
Add profit	0	0¾
Price of each	0	6

Cutting and forming Holes to receive Ends of Timbers, Girders, &c.—Although these are described as "cut for and pinned," they are, of course, merely built in and pointed up as the work proceeds. The area of end is not supposed to exceed 36 sq. ins. for small timbers, and when above this the section should be stated. Ends of joists are not included under this heading, as they do not necessitate extra labour.

	s.	d.
Labour, ¼ hour bricklayer and labourer at 1*s.* 5½*d.*	0	4¼
Cement for pinning	0	1½
	0	5¾
Add profit	0	0¾
Price of each	0	6½

And if we take the length inserted as resting $4\frac{1}{2}$ in., then $6\frac{1}{2}d. \div 4\frac{1}{2}$ in. $= 1\frac{1}{2}d.$ per inch deep.

Holes Cut for small Pipes, Bolts, &c.—The price of this would vary according to the thickness of wall, the pipe being stated not to exceed 2 in. diameter. For a 1-brick wall allow :—

	s.	d.
Labour, $\frac{1}{2}$ hour bricklayer at $10\frac{1}{2}d.$	0	$5\frac{1}{4}$
Cement for making good	0	$2\frac{1}{4}$
	0	$7\frac{1}{2}$
Add profit	0	1
Price of each	0	$8\frac{1}{2}$

And $8\frac{1}{2}d. \div 9$ in. thickness of wall $= 1d.$ per inch deep. Allow $\frac{3}{4}$ hour for $1\frac{1}{2}$-brick wall, and 1 hour for a 2-brick wall, with cement in proportion.

Paving.

Paving of hard Stocks, laid and jointed with Cement, Flat.—This will require 35 bricks, and 1 cubic foot, or $\frac{4}{5}$ bushel, of cement per yard super. The labour will be $\frac{3}{4}$ hour of a bricklayer and labourer.

	s.	d.
35 stock bricks at 35s. per 1,000	1	3
$\frac{4}{5}$ bushel cement at 1s. 10d.	1	$5\frac{1}{2}$
Labour, $\frac{3}{4}$ hour bricklayer and labourer at 1s. $5\frac{1}{2}d.$	1	1
	3	$9\frac{1}{2}$
Add profit	0	$6\frac{1}{2}$
Price per yard super.	4	4

Ditto, ditto, on Edge.—Here 52 bricks are required per yard superficial, and a little more mortar, about 1 bushel, owing to the additional number of joints. Time 1 hour in this case.

	s.	d.
52 stock bricks at 35s. per 1,000	1	10
1 bushel cement	1	10
Labour, 1 hour bricklayer and labourer	1	$5\frac{1}{2}$
	5	$1\frac{1}{2}$
Add profit	0	$10\frac{1}{2}$
Price per yard super.	6	0

Paving of vitrified blue Staffordshire 8-panel Stable Paving Bricks, with bevelled Edges, laid and jointed with Cement.—This is one of the best stable pavings. The dimensions are 9 in. × 4½ in. × 3 in., and so only 32 go to the square yard, with ⅕ bushel of cement as before. The price at works in Staffordshire is 67*s.* per 1,000, and add 30*s.* for carriage (4 tons weight per 1,000 × 7*s.* 6*d.* rate per ton in 5-ton lots = 30*s.* per 1,000) = 97*s.* at London station, plus 5*s.* for cartage = 102*s.* delivered on site.

	s.	*d.*
32 blue Staffordshire stable bricks at 102*s.* per 1,000	3	3
⅕ bushel cement at 1*s.* 10*d.*	1	5½
Labour, ¾ hour bricklayer and labourer at 1*s.* 5½*d.*	1	1
	5	9½
Add 15 per cent. profit	0	10½
Price per yard super.	6	8

Paving of Candy's "Olympia" buff vitrified Stable Paving Bricks, laid and jointed with Cement.—These are 9 in. × 4½ in. × 2¼ in., with two longitudinal grooves, and 32 cover a yard, if laid straight. Cement and labour as before. Candy's bricks cost 98*s.* per 1,000 in London, delivered in 6-ton truck loads, plus 5*s.* cartage = 103*s.* on site.

	s.	*d.*
32 Candy's buff stable paving bricks at 103*s.* per 1,000... ...	3	3½
⅕ bushel cement at 1*s.* 10*d.*	1	5½
Labour, ¾ hour bricklayer and labourer at 1*s.* 5½*d.*	1	1
	5	10
Add profit	0	10
Price per yard super.	6	8

The above tallies with an actual job, where it was found 4⅔ bushels of cement were required per stall (6 yards super.), and a bricklayer and labourer could lay two stalls per day, twenty stalls being watched.

Paving of Staffordshire Quarries, 6 in. × 6 in., laid and jointed with Cement.—These tiles, or "quarries" as they are termed in the trade, are of many qualities and colours, differing in price from about 6*s.* to 10*s.* per 100, delivered in London. The trade discount is 10 to 50 per cent. A fair rate for average quality would be 8*s.* per 100, and there are 36 of this size tile to the square yard. The attendance of a labourer would be small, most of the work

in connection with the laying being performed by the bricklayer alone.

		s.	d.
36 Staffordshire quarries, 6 in. × 6 in., at 8*s.* per 100	... ...	2	10½
Cement for laying and jointing, ⅙ bushel at 1*s.* 10*d.*	... ...	0	3½
Labour, 2 hours bricklayer at 10½*d.*...	... ...	1	9
Attendance, ½ hour labourer at 7*d.* ...	... ...	0	3½
		5	2½
Add 15 per cent. profit	... ...	0	9½
Price per yard super.	... ...	6	0

The labour will be increased if tiles of more than two colours have to be selected when laying, or when the pattern is elaborate.

In sending, the carriage from manufacturers' works in the west of England to London will be 6*d.* to 8*d.* per square yard, with an additional 6*d.* per square yard for packing thin tiles in casks, and 8*d.* for thick ones. Strips and borders have different prices to plain tiles.

Paving of pressed or Tesselated Tiles, 4 in. × 4 in., laid and jointed with Cement.—The following is an instructive analysis of a tiled floor, as carried out in the country under the author's observation. The tiles were red encaustic, 4 in. square, laid diagonally in a porch, with a border of smaller strips in three colours, red, buff, and black. The pattern was common, and the tiles were bedded and jointed in cement, on concrete already put down. The porch measured 8 ft. 6 in. × 6 ft., and the tiling was also extended into two doorways, making a total area of 6⅔ yards super. The contractor received a quotation from a well-known manufacturer, but no trade discount was allowed, as the quantity was so small, only a cash discount. The following is the detail of whole cost:—

		£	s.	d.
6⅔ yards super. best tesselated tiles at 5*s.* per yard, P.C....		1	11	1¼
Packing ditto at 6*d.* per yard super.	... ...	0	3	1
		1	14	2¼
Less 2½ per cent. discount for cash ...	... ...	0	0	10¼
		1	13	4
Carriage from manufacturer's to local railway station	...	0	7	3
Cartage from ocal railway station to site (3 miles)	...	0	0	9
	6⅔)	2	1	4
Cost of tiles only, delivered, per yard super.	...	0	6	7¾

	£	s.	d.
Cement for bedding and jointing $6\frac{2}{9}$ yards super. = 1 bushel at 2*s.* 6*d.* (local price)	0	2	6
Labour, 38 hours bricklayer and labourer at 1*s.* $1\frac{1}{2}$*d.* ($9\frac{1}{2}$*d.* + 4*d.*, local wages)	2	2	9
$6\frac{2}{9}$)	2	5	3
Cost of cement and labour per yard super. ...	0	7	$3\frac{1}{4}$

Therefore—

	s.	d.
Cost of tiles only delivered	6	$7\frac{3}{4}$
Cost of cement and labour	7	$3\frac{1}{4}$
	13	11
Add 15 per cent. profit, &c.	2	1
Total price per yard super.	16	0

The contractor's price in the quantities was only 10*s.* per yard superficial, so it is evident he undervalued his labour, as it was stipulated in the quantities that the prime cost of the tiles should be 5*s.* per yard. As the labour was three times what it ought to have been the builder admitted this was due to dilatoriness, and lack of supervision. The foregoing is a good example of how money may be lost on an item.

Miscellaneous.

Core and Parget Smoke Flues.—This is generally stated by the number, without giving size or length, which is an unsatisfactory practice. The contractor in such a case must find out particulars from the drawings. The saving of brickwork by the non-deduction of flue in the Quantities should pay for the labour in forming, so that only the parget rendering of lime and cowdung (1 lime to 3 dung) need be reckoned. For a flue 9 in. × 9 in. (3 ft. perimeter) and 40 ft. long, the value of the materials for pargetting would be :—

	s.	d.
40 . 0		
3 . 0		
120 . 0 = $13\frac{1}{3}$ yards super. of rendering material at $1\frac{1}{4}$*d.*...	1	$4\frac{3}{4}$
Add profit	0	$1\frac{1}{4}$
Cost per flue	1	6

This is generally considered too low an estimate, but it is commonly adopted. A better mode of valuation would be to state size of flue and to price at per foot run, at say 1*d.* for

above size, which would be much nearer the mark. This would give 3*s.* 4*d.* per flue (40 ft. long) instead of 1*s.* 6*d.*

Terra-cotta Chimney-pot, 3 ft. high, and Flaunched in Cement.—The wholesale trade price of a terra-cotta chimney-pot, 3 ft. high, and of plain design, would average 3*s.* 6*d.*, but it greatly varies. The trade discount off published lists is some 15 per cent. It will have to be set and flaunched, or floated about with a weathering of cement.

	s.	*d.*
Net cost of chimney-pot, 3 ft. high	3	6
Cement, ¼ ft. cube at 1*s.* 11*d.*	0	6
Setting, &c., ½ hour bricklayer and labourer at 1*s.* 5½*d.*	0	9
	4	9
Add profit	0	9
Price of each	5	6

The following was noted during the setting of 36 chimney-pots, 18 in. high and 9 in. diameter, on nine chimney shafts 26 ft. above ground :—9 ft. cube of cement mortar, 1 to 1, were used, or ¼ ft. cube per pot, the flaunching being 4½ in. high. For labour in lifting, fixing, and flaunching a bricklayer and labourer took 12 hours, or ⅓ hour per pot. This was just ordinary work and pace on a terrace of two-story houses.

Terra-cotta Air-bricks, 9 in. × 3 in. and Built in.—These cost 30*s.* per hundred. The inside of the air-flue opening would be rendered in cement mortar, and the area would be 24 in. girth by 9 in. deep, for 1½-brick wall.

	s.	*d.*
1 terra-cotta air-brick, 9 in. × 3 in., at 30*s.* per 100	0	3½
Rendering in cement mortar, 24 in. × 9 in. = 1 ft. 6 in. area	0	5
Labour, ½ hour bricklayer at 10½*d.*	0	5¼
	1	1¾
Add profit	0	2¼
Price of each	1	4

The price of 9 in. × 6 in. air-bricks is about 75*s.* per hundred, and this size fits two courses in height. Sometimes galvanised "air-bricks" are specified instead of terra-cotta ones.

Coke Breeze Concrete Bricks, 1 to 5, and Built in.—The following materials and labour were required to produce 80

breeze bricks, 9 in. × $4\frac{1}{2}$ in. × 3 in., in the proportion of 1 cement to 5 breeze. There were two wooden moulding boxes, each with spaces for 40 bricks, the use of which must not be forgotten. As the materials shrank a third when wetted, 9 ft. cube ($7\frac{1}{2}$ ft. cube breeze and $1\frac{1}{2}$ ft. cube cement) were needed in the dry to yield the 6 ft. cubical content of the 80 bricks, allowing for waste.

		s.	d.
Coke breeze, $7\frac{1}{2}$ ft. cube at 3*s.* 6*d.* per yd. cube		2	0
Portland cement, $1\frac{1}{2}$ ft. cube, or $1\frac{1}{5}$ bushels at 1*s.* 10*d.*		2	$2\frac{1}{2}$
Water, 9 gals., at say 1*d.* per 25 gals.		0	$0\frac{1}{2}$
Labourer, cleaning moulds, filling, and taking out bricks when set, $7\frac{1}{2}$ hours at 7*d.*		4	$4\frac{1}{2}$
Use of wooden moulds		1	0
		9	$7\frac{1}{2}$
Add 15 per cent. profit		1	$5\frac{1}{2}$
Price of 80 bricks	80)	11	1
Price per brick		0	$1\frac{3}{4}$
Building in		0	$0\frac{1}{4}$
Price of each built in		0	2

Another trial of 288 bricks, cast at one time, was as follows :—

		s.	d.
Coke breeze, 27 ft. cube or 1 yard cube at 3*s.* 6*d.*		3	6
Cement, 5·4 ft. cube, or $4\frac{1}{3}$ bushels at 1*s.* 10*d.*		8	0
Water, 32 gals., at say 1*d.* per 25 gals.		0	1
Labourer, 27 hours at 7*d.*		15	9
Use of moulds, say		3	0
		30	4
Add 15 per cent. profit		4	6
Price of 288 bricks...	288)	34	10
Price per brick		0	$1\frac{1}{2}$
Building in		0	$0\frac{1}{4}$
Price of each built in		0	$1\frac{3}{4}$

The actual cost was thus cheaper, owing to the larger quantity made.

Coke Breeze Concrete Lintels.—This breeze concrete was also 1 to 5, and the lintels were fixed on first floor at about 20 ft. above ground. The materials and time were taken on eight lintels, the cubical contents of which together were

exactly a yard cube. The following includes hoisting and casting in position :—

	s.	d.
Coke breeze, 32 ft. cube at 3*s.* 6*d.* per yard cube	4	2
Portland cement, 6·46 ft. cube, or 5 bushels at 1*s.* 10*d.* ...	9	2
Water, 38 gals., at, say, 1*d.* per 25 gals.	0	1½
Labourer, 27 hours at 7*d.*	15	9
Carpenter making casing, 4 hours at 10½*d.*	3	6
Use of casing, ⅓ of 106 ft. super. at 1½*d.*	4	5
	37	1½
Add 15 per cent. profit	5	6½
Price per yard cube	27)42	8
Price per foot cube	1	7

The contractor for the same work priced his lintels from 10*d.* per ft. cube for large sized ones, to 1*s.* 9*d.* per ft. cube for small ones. According to the foregoing actual analysis (for large lintels averaging 4 ft. 9 in. × 12 in. × 9 in.) such rates were not enough.

CHAPTER IX.—MASON.

MEMORANDA.

Weights of Stones.

Stone.	County.	Weight per Ft. Cube.	Ft. Cube per Ton.
		Lbs.	
Abercarne	Monmouthshire ...	166	13½
Ancaster	Lincolnshire	140	16
Anston	Yorkshire	141	16
Bath	Somersetshire	140	16
Beer	Devonshire	132	17
Bolsover	Derbyshire	150	15
Bramley Fall	Yorkshire	142	16
Chilmark or Wardour	Wiltshire	135	16½
Corsehill	Dumfriesshire	154	14½
Craigleith	Edinburgh	145	15½
Darley Dale	Derbyshire	148	15
Doulting	Somersetshire	134	16½
Forest of Dean	Gloucestershire ...	149	15
Granite	Aberdeenshire	166	13½
,,	Cornwall	172	13
,,	Devonshire	172	13
,,	Guernsey	180	12½
Hopton Wood	Derbyshire	158	14
Kentish Rag	Kent	166	13½
Ketton	Rutlandshire	128	17½
Mansfield, red	Nottinghamshire...	148	15
Marble, Sicilian	From Carrara, near Leghorn, Italy ...	169	13
Painswick	Gloucestershire ...	140	16
Parkspring	Yorkshire	151	15
Portland, best bed	Dorsetshire	135	16½
,, roach	,,	150	15
Purbeck	,,	160	14
Roche Abbey	Yorkshire	139	16
Scotgate Ash	,,	153	14½
Whinstone	,,	172	13

The foregoing weights have been given in round numbers, chiefly for the purpose of calculating carriage and cartage.

Weights of Paving and Slabs.

Description.	Thickness.	Weight per Ft. Super.	Ft. Super per Ton.
	In.	Lbs.	
Yorkshire paving	2	26	86
,, ,,	2½	32½	69
,, ,,	3	39	57½
,, ,,	3½	45½	49
,, ,,	4	52	43
,, ,,	4½	58½	38
,, ,,	5	65	34½
,, ,,	5½	71	31½
,, ,,	6	78	29
Purbeck paving	2	27	83
,, ,,	2½	33¾	66½
,, ,,	3	40½	55¼
,, ,,	3½	47¼	47½
,, ,,	4	54	41½
,, ,,	4½	60¾	37
,, ,,	5	67½	33
,, ,,	5½	74	30
,, ,,	6	81	28
Granite paving	3	41	54½
,, ,,	4	55	40¾
,, ,,	6	82	27¼
,, ,,	9	123	18
Marble slabs	½	7·17	308⅓
,, ,,	¾	10·75	208⅓
,, ,,	1	14·33	163⅓
,, ,,	1¼	17·92	125
,, ,,	1½	21·5	104
,, ,,	1¾	25·08	89¼
,, ,,	2	28·67	78
,, ,,	2½	35·83	62¼
,, ,,	3	43	52

Rubble Masonry.

1 yd. cube random work requires 33 ft. cube rough stone, and 9 ft. cube mortar.

1 yd. cube coursed work requires 35 ft. cube rough stone, and 6½ ft. cube mortar.

Solid masonry = 160 lbs. per ft. cube.
Stacked ,, = 93 ,, ,,

Flint Walling.

1 yd. cube requires 30 ft. cube rough flints, and 9 ft. cube mortar.
Also 1¼ ft. cube split flints to 1 yd. super. of face.
1 ton of flints = 32 ft. super. of flint facing with whole flints.
,, ,, = 50 ,, ,, ,, knapped flints.

Ashlar Masonry.

1 ft. cube requires $1\frac{1}{10}$ ft. cube of undressed stone, and $\frac{1}{8}$ to $\frac{1}{12}$ ft. cube mortar.

Pointing ashlar masonry requires per yd. run of joint from $\frac{1}{20}$ to $\frac{1}{30}$ ft. cube of mortar, according to thickness.

Miscellaneous.

1 square perch = 21 ft. super., 18 in. thick, standard thickness; or
1 ,, ,, = 18 ,, 2 ft. ,, ,, ,,
1 rood = 36 yds. super., 2 ft. thick = 24 yds. cube.
1 cord of stone = 100 ft. cube of built walling, or 128 ft. cube (8 ft. × 4 ft. × 4 ft.) of loose stone.
1 ft. cube of masonry = 140 to 160 lbs. weight.
1 ton of ordinary stacked rubble stone = 22 to 26 ft. cube.
1 load of rubble or stone paving = $1\frac{1}{2}$ ton.

A quarryman is able to turn out per day from 5 to 8 tons of limestone and other stratified rock, and from $\frac{1}{2}$ to 1 ton of granite.

PRICES.

Waller.

		s.	d.
Rubble walls of local stone in random courses, in lime mortar	per yd. cube	18	9
Ditto in squared courses, in lime mortar ...	,,	20	8
Rough random walling of Kentish rag, in lime mortar	,,	17	0
Rough-coursed ditto, ditto	,,	21	0
Rubble flint walling laid in courses, well grouted and pointed	,,	16	0
Taking down old rubble walls in mortar, and cleaning and stacking	,,	3	9
Kentish rag, free from bassock, supplied only ...	,,	9	6
Flints unbroken, as received from quarry ...	,,	7	0
Ditto, broken to $1\frac{1}{2}$-in. cube	,,	9	6
Ditto, broken to 2-in. cube	,,	9	0
Galleting joints with knapped flints in lime mortar	per yd. sup.	2	0
Raking out joints of rubble masonry and pointing with coal-ash mortar	,,	0	9
Ditto, ditto, with cement	,,	1	3
Add for faces of rubble flint work, neatly pointed with coal-ash mortar	,,	0	8
Ditto, ditto, with Portland cement	,,	0	10
Cutting into old masonry to form toothing for, and bonding in new work, face measure only to be taken, but including value of new stone in bonding, all materials and labour, in mortar ...	per ft. sup.	0	6
Ditto, ditto, in cement	,,	0	8
Rough cutting to rakes and splays, straight ...	,,	0	2
Extra for labour in forming external or internal angles	per ft. run	0	$1\frac{1}{2}$

Prices—*continued.*		s.	d.
Roughly squaring quoin stones	per ft. run	0	5
Rubble for breakwaters, sea-walls, and similar purposes	per ton	8	0
Stone for rubble work, at the quarries	,,	3	6
Kentish rag, delivered within 4 miles of Thames	,,	6	10
Headers, ditto	,,	14	3

Mason.

PORTLAND STONE.

(In lengths not exceeding 6 ft., or above 40 ft. cube, and including hoisting 30 ft.)

		s.	d.
Portland stone in block, rough quarry-scabbled, delivered at London terminus	per ft. cube	2	1
Ditto, roughly squared, including carting to site, and setting in lime mortar	,,	4	4
Ditto, but including half-sawing to faces, beds, and joints, and ditto	,,	5	0
Add if set in cement...	,,	0	2½
Hoisting stone above 30 ft., for each additional 10 ft....	,,	0	1
Taking down ashlar stone in wall, clean and stack	,,	0	2
Arch stones, or voussoirs, rubbed on exposed faces, and set in cement	,,	9	0
Bases for columns, plain worked where seen, chamfered on top edges, sunk for iron column, and set in lime mortar	,,	10	6
Coping, double-weathered and throated, with beds and joints, and set in lime mortar	,,	11	9
Cornice, weathered, with moulding 18 in. girth, rubbed, and set in lime mortar	,,	19	9
Curb, rubbed on exposed faces, double chamfered, and set in lime mortar	,,	16	0
Hinge stones, worked fair on exposed faces, squared back joints, and parallel beds, rebated, and set in lime mortar	,,	11	0
Pier caps, worked plain, weathered on top, throated all round, and set in lime mortar ...	,,	12	6
Plain rubbed jambs, quoins, heads, bands, templates, or corbels, and set in lime mortar ...	,,	6	6
Steps, square, worked smooth on tread and riser, and set in lime mortar	,,	7	0
Steps, spandril or winders, and ditto	,,	8	0
Window-sills, sunk, weathered, throated, grooved, and with seats, and set in lime mortar ...	,,	11	6
Ashlar, 4 in. thick on bed, including beds, joints, face, and set	per ft. sup.	2	8
Add for every inch thickness on bed	,,	0	9
Arch stones, or voussoirs, 14 in. by 18 in. by 9 in., rubbed on exposed faces, and set in cement ...	each	12	0
Balusters, 5 in. diameter, and 18 in. high, turned to ordinary pattern	,,	8	0

LABOUR.		Straight.	Circular.
		s. d.	s. d.
Face work with roughly punched or picked centre, and drafted margin not exceeding 1½ in. wide	per ft. sup.	0 10	1 3
Roughly dressing sides of blocks	,,	0 1½	0 2¼
Half-sawing	,,	0 3	0 4½
Half-plain or sawn work (one face measuring for two)	,,	0 6	0 10
Plain work, as in beds and joints	,,	1 0	1 9
Sunk work, as in splays, weathering, batters	,,	1 4	2 1
Ditto, as in rebates, grooves, niches ...	,,	2 0	3 2
Moulded work, as in cornices	,,	3 0	4 5
Plain circular work, and in shafts of columns	,,	—	2 4
Circular circular work, as in spheres ...	,,	—	3 9
Rubbed work, extra only to foregoing, plain	,,	0 2	0 2½
Ditto, ditto, sunk	,,	0 2½	0 3
Ditto, ditto, moulded	,,	0 3	0 3½
Back joints to steps	per ft. run	0 2	0 3
Beading, single, not exceeding 2 in. girth ...	,,	0 5	0 7
Chamfer, not exceeding 1 in. wide	,,	0 1½	0 2
Ditto, exceeding 1 in., but not exceeding 3 in. wide	,,	0 3	0 4½
Flutes, not exceeding 1½ in. girth	,,	0 3	0 5
Grooves, not exceeding 3 in. girth	,,	0 4½	0 6
Ditto, small or throat, as for tongues of window-sills	,,	0 1½	0 2¼
Moulding, not exceeding 3 in. girth ...	,,	0 10	1 2
Rebate, ditto	,,	0 4	0 5½
Rounded edge, ditto	,,	0 2¾	0 4½
Tooled edge, ditto	,,	0 3	0 5

		s. d.
Mitred angles, external, to sunk work, chamfers, grooves, rebates, &c.	each	0 2
Ditto, internal, ditto, ditto	,,	0 3
Stopped ends to small chamfers, grooves, rebates, &c.	,,	0 1½
Mortises for rail holes, balusters, dowels, lewis ends of bolts, &c., each hole not exceeding 3 cubic inches	,,	0 3
Add if run with lead (labour, fuel, and lead) ...	,,	0 3
Mortises for newels	,,	0 10
Letting in door scrapers into step, and run with lead (labour, fuel, and lead)	,,	1 6
Rounded ends to plain steps	,,	0 8
Rounded corners ditto	,,	0 6
Fair ends ditto	,,	0 3
Fair ends to window sills, if taken separately ...	,,	0 4
Seats for jambs ditto, ditto	,,	1 0
Cutting plain letters, figures, lines, &c.	per inch	0 2½

YORK STONE.

		s.	d.
Yorkshire stone in block, 20 ft. cube average ...	per ft. cube	3	3
Ditto, including waste and cartage within 4 miles of London depôt	,,	4	0
Ditto, including hoisting, scaffolding, and setting	,,	5	3
4-in. landings, tooled, plain face both sides, set in mortar	per ft. sup.	3	3
6-in. ditto, ditto, ditto	,,	3	9
2-in. paving, quarry-tooled on face, jointed, and set in mortar	,,	1	2
3-in. ditto, ditto, ditto	,,	1	4
Add if rubbed or fine tooled...	,,	0	3
Add if laid and jointed in cement instead of mortar	,,	0	2
Taking up stone paving, cleaning, and removing under 50 yards	,,	0	1
Taking up old paving, squaring, and relaying in lime mortar	,,	0	3
6 in. by 6 in. tooled curbs, top and one face plain and one jointed, and fixed	per ft. run	2	7
7 in. by 6 in. ditto, ditto, ditto	,,	2	9
8 in. by 6 in. ditto, ditto, ditto	,,	3	0
9 in. by 6 in. steps, both faces tooled plain, and fixed	,,	3	8
12 in. by 6 in. ditto, ditto, ditto	,,	4	0
Add if rubbed	,,	0	3
Parallel coping, two throats, 13 in. wide	,,	1	9
Ditto, ditto, 18 in. wide	,,	2	9
Joggle joint to landings, and run with cement ...	,,	1	0
Edges coped or sawn to 2-in. paving, straight ...	,,	0	1½
Ditto 3-in. ditto	,,	0	2½
Sunk rebate on edge of paving	,,	0	1½
Scribing or bevel cutting, including waste ...	,,	0	2
Circular cutting, including waste	,,	0	6
Channel stones, 12 in. by 4 in., quarry-faced, with circular sunk channel, set and jointed in cement	,,	2	4
Taking up ditto, and clean and stack	,,	0	1½
Rounded ends to plain steps	each	0	10
Rounded corners ditto	,,	0	8
Fair ends ditto	,,	0	5
Fair ends to window sills	,,	0	6
Notches in paving, or hearths for jambs	,,	0	6
Returned ends and junctions to channels ...	,,	0	8
Stopped ends to ditto...	,,	0	4
Holes, 1 in. diameter, drilled or jumped for bolts	per inch	0	1

ABERDEEN GRANITE.

Aberdeen granite in block, rough quarry-scabbled, and set in lime mortar	per ft. cube	6	6
Ditto, but quarry-dressed and squared, and ditto	,,	8	6
Add if set in Portland cement mortar	,,	0	7
Plain work to ditto, straight	per ft. sup.	2	0
Ditto, circular...	,,	3	0
Half-plain or sawn work, straight	,,	1	0

ABERDEEN GRANITE—*continued.*

		s.	d.
Ditto, ditto, circular	per ft. sup.	1	6
Moulded work, as in cornices, straight	„	5	0
Ditto, ditto, circular	„	7	6
Add to foregoing for fine-axed face...	„	0	9

MISCELLANEOUS.

Ordinary work carried out in Bath stone, prepared ready for fixing, delivered in London	per ft. cube	4	6
Slate dowel, 1 in. to 2 in. square, and 2 in. to 4 in. long, and run with cement, including mortise...	each	0	8
Letting in coping cramps with cement	„	0	6
Window-sills or steps taken up and removed to store	„	0	9
Pinning in ends of sills or steps in cement ...	„	0	6
Perforations, with sides dressed plain, for areas not exceeding 1 ft. super., in Portland stone ...	per inch deep	0	6
If done in position	„	0	9

MATERIALS.

(SUPPLIED ONLY.)

Fuse, Bickford's	per coil of 4 fathoms	0	10
Powder for blasting	per lb.	0	8
Lead for running in mortises	„	0	3
Cement, Portland	per bushel	1	10
Lime, ground fine, stone, grey Dorking ...	„	0	8¼
Ditto, ditto, lias, Lyme Regis	„	0	10
Ditto, ditto, white chalk	„	0	7¼
Sand, pit or river, clean, sharp, unwashed ...	per yd. cube	6	9
„ „ „ washed	„	10	0
Lime mortar, fine stuff	per ft. cube	0	9½
„ grey stone, plain, white	„	0	7
„ „ „ ash	„	0	8
Portland cement mortar, neat	„	1	11
„ „ 1 to 1	„	1	7
„ „ 1 to 2	„	1	3
„ „ 1 to 3	„	0	11
Wages, waller (local)...	per hour	0	9
„ mason	„	0	10½
„ mason, granite or marble	„	0	11¼
„ mason's labourer	„	0	7
„ stone-carver	„	1	4

ANALYSIS.

WALLER.

Men who do rubble-work are termed "wallers," and have a distinct trade from the stonemasons or hewers.

Rubble masonry is usually measured by the cubic yard, the thickness of the walls being stated. This standard can be

afterwards reduced to a cubic foot, which is sometimes taken instead. Walls 12 in. thick and under are kept separate.

Rubble Walling of Local Stone in Random Courses in Lime Mortar.—Random or common uncoursed rubble-work will require 33 cubic feet, or say 1¼ cubic yard, of stone (including waste), per yard cube. As 24 cubic feet of rubble stone stacked equal 1 ton, therefore the 33 cubic feet required per yard cube of work are equivalent to about 1⅓ ton, the stone being sold by weight. About 9 cubic feet of mortar will be needed to fill up the voids. Labour, 3 hours of waller and labourer.

	s.	d.
1¼ cubic yard, or 1⅓ ton of rubble stone at 3*s*. 6*d*. per ton ...	4	8
1⅓ ton = say 1 load carting stone	2	6
9 cubic feet of lime mortar at 7*d*.	5	3
Waller and labourer, 3 hours at 1*s*. 3½*d*. (9*d*. + 6½*d*.)	3	10½
	16	3½
Add 15 per cent. profit	2	5½
Price per yard cube	18	9

Price per foot cube = 18*s*. 9*d*. ÷ 27 = 8¼*d*.

Rubble Walling of Local Stone in Squared Courses in Lime Mortar.—About 35 cubic feet, or say 1⅓ cubic yard, of stone will now be required if in thick walls, as the squaring will necessitate greater waste, and hence rather more rubble. The 1⅓ cubic yard would weigh some 1½ ton. Less mortar (6½ cubic feet) and more labour (5 hours) are now necessary, on account of the cutting of the stone to a better fitting shape.

	s.	d.
1⅓ cubic yard, or 1½ ton of rubble stone at 3*s*. 6*d*. per ton ...	5	3
1½ ton = 1 load carting stone	2	6
6½ cubic feet of lime mortar at 7*d*.	3	9½
Waller and labourer, 5 hours at 1*s*. 3½*d*. (9*d*. + 6½*d*.)	6	5½
	18	0
Add 15 per cent. profit	2	8
Price per yard cube	20	8

Price per foot cube = 20*s*. 8*d*. ÷ 27 = 9*d*.

The foregoing does not include pointing. If walls are built in cement half an hour's more time will be consumed in labour.

Taking down old Rubble Walls in Mortar, and Cleaning and Stacking the Stone.—This is merely a question of labour, and a labourer can execute a yard cube of this in six hours.

	s.	d.
Taking down old rubble walls, 6 hours labourer at $6\frac{1}{2}d.$	3	3
Add profit	0	6
Price per yard cube	3	9

Price per foot cube = 3*s*. 9*d*. ÷ 27 = $1\frac{3}{4}d.$

Mason.

In the valuation of stonework the points for consideration are the price at quarry and the state in which it is sent from there, the cost of carriage, the final cost when delivered, and then the valuation of the different labours according to the finish required, the setting, and the profit on the whole. If the stone is worked at the quarry, there is a saving in the weight for railway carriage; but then the cost of that is 10 per cent. more than for rough stone. Freshly-quarried stone is more easily worked than when seasoned. Granite is usually quarry-worked.

A large proportion of the stone trade is done through merchants, and several large quarry-owners look to them only for their business. The ordinary building contractor is not always competent to undertake the stonework, and it is better for him to let the work to a firm of stone merchants.

The table on p. 151 shows how the prices are arrived at for stone delivered in London, and from this and the relative value of labour the costs of items in other kinds of stone may be readily ascertained by comparison with Portland. The railway rate refers to full truck-loads of about four tons and upwards.

Measurement of Stone Work.—The London practice is to measure the stone per foot cube in rough blocks, and then measure the labour to each face separately in detail at per foot super. There is an exception in the case of ashlar work, which is usually described at per foot super., including beds and joints, and stating average thickness; as, for example, the alternate courses to be 9 in. and $4\frac{1}{2}$ in. on bed and 12 in. high, and specifying bond-stones.

Another method is to include all labour with the cubic contents, giving full descriptions and sketches. The former is the more exact, but the latter is frequently adopted to save trouble.

As already stated, the full dimensions of the block-stone which will contain the proposed finished stone must be taken, and in large blocks 1 in. is allowed each way for irregularities and waste. If an experienced mason can saw

or cut two or more pieces out of a block which is only supposed to be sufficient for one, then that would go to his credit, and no deduction would be made.

Beds and Joints.—If these are measured in with the stonework allow 1½ ft. super. per cubic foot of stone in classic work, and 2 ft. super. in Gothic work.

LABOUR.

There is considerable difference of opinion as to the descriptions of the various labours executed on stonework, but the list below is generally accepted. As the cut of a saw will divide a stone into two pieces, the labour to each face so cut is described as "half"-sawing. When other labours are stated they include this item, which is only taken to a surface when no other labour is intended. Half-sawing is more frequently called half-bed or half-joint, but the old description is more precise. Plain work is the surface produced after all inequalities have been dressed down, so as to yield a plain face or even surface, which may be tooled stroke for hard stones, such as Portland or York, or a combed or dragged face for soft stones like Bath or Doulting.

The time constants per foot super. and cost are those applicable to Portland stone, which is the best known in the kingdom.

	Constant. Hours mason.		Per ft. super. s.	d.
Roughly dressing sides of blocks	·15	at 10½*d*. =	0	1½
Half-sawing	·30	,, =	0	3
Half-plain or sawn work, straight, as in beds or joints	·56	,, =	0	6
Ditto, circular, ditto, ditto	·95	,, =	0	10
Plain work, straight, as in faces, &c.	1·15	,, =	1	0
,, circular ,, ...	2·00	,, =	1	9
Sunk work, straight, as in splays or batters ...	1·53	,, =	1	4
,, circular ,, ,, ...	2·40	,, =	2	1
,, straight, as in rebates	2·30	,, =	2	0
,, circular ,, ...	3·60	,, =	3	2
Moulded work, plain, straight, as in cornices ...	3·40	,, =	3	0
,, ,, circular ,, ,, ...	5·00	,, =	4	5
Circular work to shafts of columns	2·70	,, =	2	4
Circular circular work, as in spheres and balls ...	4·30	,, =	3	9
Rubbed work, extra only to foregoing, plain, straight ...	·20	,, =	0	2
,, ,, ,, circular	·24	,, =	0	2½
,, ,, ,, sunk, straight ...	·24	,, =	0	2½
,, ,, ,, ,, circular ...	·30	,, =	0	3
,, ,, ,, moulded, straight	·30	,, =	0	3
,, ,, ,, ,, circular	·33	,, =	0	3½

ANALYSIS OF THE PRIME COST OF STONES DELIVERED IN LONDON.

Name of Stone.	State sent.	Net price at Quarry per F.C.	Number of F.C. per ton.	Cost of Carriage per ton to London.	Cost of Carriage per F.C. to London.	Cost per F.C. delivered at London Terminus.
		s. d.		s. d.	s. d.	s. d.
Abercarne, Monmouthshire	Random blocks.	0 4¼	13½	14 6	1 0¾	1 5
Ancaster, Lincolnshire	,, ,,	1 3	16	9 4	0 7	1 10
Anston, Yorkshire	,, ,,	1 3	16	10 0	0 7½	1 10½
Bath, Somersetshire	,, ,,	1 0	16	10 4	0 7¾	1 7¾
Bolsover, Derbyshire.....................	,, ,,	2 0	15	8 9	0 7	2 7
Bramley Fall, Yorkshire	,, ,,	1 0	16	16 0	1 0	2 0
Chilmark or Wardour, Wiltshire ...	,, ,,	1 8	16½	6 0	0 1¼	1 9¼
Corsehill, Dumfriesshire	,, ,,	1 4¾	14½	15 6	1 1¼	2 6
Doulting, Somersetshire	,, ,,	1 6	16	8 0	0 6	2 0
Granite, Aberdeenshire..................	Scabbled to size.	—	13½*	—	—	4 0
Granite, Devonshire	,, ,,	—	13*	—	—	3 9
Hopton Wood, Derbyshire	Random blocks.	1 8	14	8 4	0 7	2 3
Mansfield, Nottinghamshire............	,, ,,	1 4	15	8 9	0 7	1 11
Painswick, Gloucestershire	,, ,,	1 0	16	8 0	0 6	1 6
Parkspring, Yorkshire	,, ,,	1 8	15	15 0	1 0	2 8
Portland, Dorsetshire	,, ,,	1 6¾	16	7 10	0 6½	2 1
Purbeck, Dorsetshire.....................	,, ,,	1 6	14	7 6	0 6½	2 0½
Roche Abbey, Yorkshire	,, ,,	0 10	16	10 6	0 8	1 6

Selected blocks 1*d.* per foot cube extra.

* Carried by rail as 16 F.C.

Work done in position is worth half as much again as the foregoing rates.

By the application of relative percentages in comparison with a well-known stone like Portland, the value of the labour on other stones may be easily ascertained and quickly priced. For example, the estimator can price all his labours at Portland rates, and either add or deduct a percentage according to the hardness of the stone employed. Thus, labour to Bath stone is 40 per cent. less, and Devonshire granite 50 per cent. more, than that of Portland. Bath stone *and* all labour compared with Portland is often priced at 25 per cent. less.

The following will give an idea of the comparative labour to a few important stones :—

The labour on	Ancaster stone	is 40	per cent.	less	than that on	Portland.
,,	Bath stone... ...	,, 40	,,	,,	,,	,,
,,	Bolsover stone ...	,, 33	,,	more	,,	,,
,,	Bramley Fall stone	,, 20	,,	,,	,,	,,
,,	Granite, Aberdeen	,, 60	,,	,,	,,	,,
,,	Granite, Devonshire	,, 50	,,	,,	,,	,,
,,	Parkspring stone ...	,, 23	,,	,,	,,	,,
,,	Yorkshire stone ...	,, 25	,,	,,	,,	,,

Labours to Stonework.

The successive stages through which freestone, such as Portland, Bath, &c., passes from the rough to the fine state are shown in Figs. 2 to 17, as follows :—

Fig. 2. Self-faced, rock-faced, or quarry-faced.
,, 3. Scabbling, scappling, or quarry-pitched.
,, 4. Hammer dressing.
,, 5. Punching.
,, 6. Pointing or picking.
,, 7. Boasting or droving.
,, 8. Tooling.
,, 9. Stroking or striping.
,, 10. Sawing or half-plain work.
,, 11. Plain work.
,, 12. Dragging or combing.
,, 13. Rubbing or polishing.
,, 14. Sunk work and half-sunk work.
,, 15. Moulded work.
,, 16. Reticulated work.
,, 17. Vermiculated work.

Scabbling, or scappling, is roughly reducing the stones to the desired shape. "Quarry-pitched" means that the protuberances on a rough block of stone are "pitched" off at the quarry by a pitching tool, which is a chisel with an

edge about $2\frac{1}{2}$ in. wide, used in conjunction with a mash hammer.

Hammer dressing is of the same nature as scabbling, but not so rough, and is executed with a waller's hammer.

Punching is a preparatory surface to *Pointing*, which latter has a pock-marked appearance, and is capable of being worked to an unusual degree of fineness, which may be a final finish. Pointing is invariably chisel-drafted

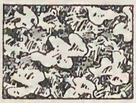

Fig. 2. Self-faced or Rock-faced.

Fig. 3. Scabbling.

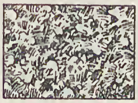

Fig. 4. Hammer Dressing.

Fig. 5. Punching.

Fig. 6. Pointing or Picking.

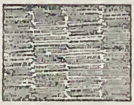

Fig. 7. Boasting or Droving.

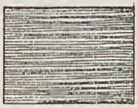

Fig. 8. Tooling.

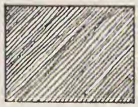

Fig. 9. Stroking or Striping.

Fig. 10. Sawing or Half-plain Work.

Fig. 11. Plain Work.

Fig. 12. Dragging or Combing.

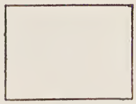

Fig. 13. Rubbing or Polishing.

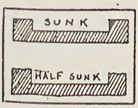

Fig. 14. Sunk Work and Half-sunk Work.

Fig. 15. Moulded Work.

Fig. 16. Reticulated Work.

Fig. 17. Vermiculated Work.

about an inch wide round the margins, which are then styled "drafted margins." These borders are here necessary to ensure proper arrises for the accurate fitting of the joints of each block, which would otherwise present an undulating surface over its whole face; they are cut with a tooth chisel.

Boasting is called Droving in Scotland, and may be described as roughly preparing for a finer finished face. It is nearly always done with the boaster, or bolster, chisel at an angle, and varies with the texture of the stone as to

the number of blows or lines to the inch, producing a corduroy appearance. Boasted work is really a levelling of the surface, and the tool often takes $\frac{1}{16}$ in. or so from the top of the stone, thus in a manner dressing it. It is, in fact, "a more regular description of chiselling, in which the marks of the tool run in parallel lines, each successive stroke being made beneath the last, down the whole length of the stone. The same operation is repeated till the marks extend over its whole breadth." The lines are not continuous across the whole width of the stone, but resemble columns. Limestones and grits are the stones which are usually boasted.

Tooling is similar to boasting, except that the strokes form a continuous series of parallel lines, each line extending across the whole of the stone. It is, in fact, superior boasting, the tooler, or broad tool, being a chisel 4 in. wide. Tooling is generally executed after the work is boasted, and is simply of an ornamental character, the operation requiring to be finely done. Each line or hollow is completed before commencing the following one, and these are always at right angles to the bed of the stone. The process of tooling is now uncommon.

Stroking, or striped work, differs only from tooling in the direction of the lines, which run diagonally instead of parallel to the edges of the stone.

Sawing, or half-plain work, is the surface produced after sawing.

Plain work is the resulting surface after the inequalities left by the saw, punch, or point have been dressed down by chisels and tools, as the former leave their traces in irregular marks over the stone. Half-plain work and plain work are the labours usually left upon the bed and side joints of cut stones in walling.

Dragging or combing is done with a thin plate of steel with teeth like a saw. It is employed on very soft stones, such as Bath, to produce an extremely even surface, for the sake of appearance and to prevent the destroying action of the weather which would otherwise take place on a rough texture.

Rubbing and polishing are produced with an iron implement, used with sand and water.

Sunk work is the labour of making any surface below that originally formed, such as in panels, sloping surfaces of sills, &c. If the original surface was smooth it is properly called sunk work; if rough, *half-sunk*.

Moulded work is as its name implies, and is, strictly

speaking, the term given to profiles with a change of curvature, and should not be applied to cylindrical sections, such as columns, which is circular work.

Reticulated work means imitating network, and *Vermiculated work* means resembling the motion of a worm. These labours are chiefly placed on quoin stones to give effect, and are enclosed by margins about $\frac{3}{4}$ in. wide. The irregularly shaped sinkings between are punched with a pointed tool to give them a rough pock-marked appearance.

Labours to Granite.

The successive stages through which granite passes from the rough to the fine state are shown in Figs. 18 to 25, as follows :—

Fig. 18. Hammer dressing or hammer-blocked.
,, 19. Scabbling.
,, 20. Punching.
,, 21. Picking.
,, 22. Bushing or bush-hammering.
,, 23. Tooth axing, or fine or close-picking.
,, 24. Axing (single, fine, and patent).
,, 25. Rubbing and polishing.

Hammer dressing merely consists in reducing and removing the roughness of the stone. Hammer-faced work is also

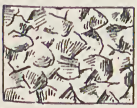
Fig. 18. Hammer Dressing.

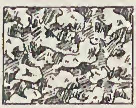
Fig. 19. Scabbling.

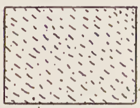
Fig. 20. Punching.


Fig. 21. Picking.

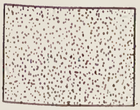
Fig. 22. Bushing.

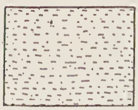
Fig. 23. Tooth Axing.


Fig. 24. Axing.

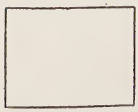
Fig. 25. Rubbing and Polishing.

said to be hammer-blocked or quarry-pitched. It is likewise termed rock or rustic work, and is mostly confined to foundations, plinths, and quoins, where a bold massive appearance is aimed at.

Scabbling is still further reducing to approximate dimensions and taking down the excessive crudeness of the hammer-dressed work.

Punching is bringing the surface to a finer face, such as for copings, curbs, channelling, &c., and for the beds and joints of rock-faced work.

Picking is a further fine face, drafted margins being usually run round the parts so dressed.

Bushing, bush-hammering or bunching, is pounding off the roughness of the stone and leaving the face approximately smooth. The face of the hammer is cut into a series of pyramidal points, varying in number and size with the work to be done. This kind of finish is only suitable for hard stones, as soft ones are apt to scale with the treatment.

Tooth axing is fine or close-picked work on ashlar masonry, and is executed with a serrated pick, 4 in. wide on edge.

In *Axing*, the *single* process consists of toning down the unevenness left by the pick, leaving marks in parallel lines, such as in drafted margins, which in granite are usually cut with a single axe. *Fine-axed* work is simply a finer description of the preceding. *Patent-axed* work is the finest description of surface work before polishing. It is employed in the best class of building, on monuments, and as a finish to contrast with polished work. The faces of the patent-axe are formed of a number of parallel thin steel blades, bound together so as to allow of their being taken out and re-sharpened.

Rubbing and polishing is a final surface on certain parts for high-class buildings, the process being performed by machinery.

Machinery.—A great deal of stonework, especially of the softer kinds, is now dressed by machinery ; but the machines are chiefly employed at quarries where large quantities of stone are worked, and there are few builders whose business is large enough to maintain them. They will not only roughly dress stone, but will saw, rub, mould, and polish it, and the advantages over manual labour are great, the saving on this alone being at least one-third. There is also a large saving of time in production. The dressing of 30 ft. of moderately hard stone by machinery will cost 2*s.*, while the same by hand would amount to 5*s.* A stone-dressing machine will work superior to clean boasted work, 180 ft. super. of ordinary hard grit stone per day of nine hours, at 1*d.* per ft. super. An ashlar step, 5 ft. by 12 in. by 7 in., can be dressed in one hour on all four sides ready for fixing. As much as 500 ft. super. of rubbing can be turned out per day with a high-speed machine 10 ft. diameter. Machine

work is beautifully sharp, and absolutely true. Machine-sawing for Portland costs 2*d.* per ft. super. as against 6*d.* by hand, and machine-rubbing from 1*d.* to 3*d.* per square foot, according to the nature of the stone.

As for turning, a Bath stone baluster 1 ft. 6 in. high by 6 in. diameter, with twelve mouldings on it, will be finished complete in a treadle lathe in half-an-hour, after first being roughed out to an octagon form. To work one of these by hand would take a good mason over three hours.

Waste.—The waste in the conversion of stone depends upon its brittleness, and the irregular shape in which it is raised from the quarry, as well as upon the style of architecture. The full cubic quantity should be measured, from which the net quantity of material obtained from the length between the finished extreme points is taken. The waste on the conversion of tooled stone will be 10 to 15 per cent., and on sawn stone 5 to 7½ per cent., which waste should be reckoned in pricing, notwithstanding the custom of measuring the stone net.

Examples: Portland Stone.

Portland Stone in Block, roughly squared, including Carting to Site, Hoisting 30 ft., and Setting in Lime Mortar.—This is for rough work, as for rubble walls, &c., and the six sides of the foot cube would be merely roughly dressed and squared. The blocks received in London usually average 20 ft. cube, and the present price is 2*s.* 1*d.* per ft. cube delivered at London terminus.

	s.	*d.*
Stone, in random blocks, delivered at London terminus, P.C. ...	2	1
Waste, 15 per cent.	0	4
Cartage to site, say	0	3
6 ft. super. of rough dressing at 1½*d.*	0	9
1 ft. cube hoisting and setting up to 30 ft., at 1*d.* per 10 ft. ...	0	3
⅙ ft. cube lime mortar at 7*d.* per foot cube	0	1
	3	9
Add 15 per cent. profit	0	7
Price per foot cube	4	4

Ditto, but including Half-sawing to Faces, Beds, and Joints, and ditto.—As this block will be cut out of a larger one, there will be half-sawing this time to the six sides of the cube. The waste now allowed is only 7½ per cent., because of the sawing.

	s.	d.
Stone, in random blocks, delivered at London terminus, P.C. ...	2	1
Waste, 7½ per cent.	0	2
Cartage to site, say	0	3
6 ft. super. of half-sawing at 3*d*.	1	6
1 ft. cube hoisting and setting up to 30 ft., at 1*d*. per 10 ft. ...	0	3
1/7 ft. cube lime mortar, at 7*d*. per foot cube	0	1
	4	4
Add 15 per cent. profit	0	8
Price per foot cube	5	0

Coping, double-weathered, 12 *in. by* 4 *in. thick, Rubbed on Top and Two Sides, Throated both Edges, including Beds and Joints, and set in Lime Mortar.*—This would be for a 9-in. wall, and as the joints would be 3 ft. apart, one stone of this length would be analysed as below. The dotted lines indicate the cubic contents out of which the block would be cut.

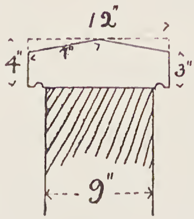

Fig. 26.

			s.	d.
3 . 0				
1 . 0				
0 . 4	1 . 0	foot cube, Portland stone delivered	2	1
		Waste, 7½ per cent.	0	2
3 . 0		Cartage to site, say	0	3
1 . 0	3 . 0	Bed.		
2/3 . 0				
0 . 3	1 . 6	Sides.		
2/1 . 0				
0 . 4	0 . 8	Ends or joints.		
	5 · 2	feet super. half-sawing to bed, sides, and joints,		
2/3 . 0		at 3*d*.	1	3½
0 . 7	3 . 6	feet super. straight sunk face to weathering,		
		at 1*s*. 4*d*.	4	8
2/3 . 0				
0 . 7				
	3 . 6	Weatherings.		
		Carried forward	8	5½

			s.	d.
		Brought forward	8	5½
2/3 . 0 0 . 3	1 . 6	Edges.		
	5 . 0	feet super. extra only for plain rubbed work, at 2*d.*	0	10
2/3 . 0	6 . 0	feet run throat at 1*d.*	0	6
	1	foot cube hoisting and setting up to 30 ft., at 1*d.* per 10 ft.	0	3
		Lime mortar at 7*d.* per foot cube	0	1
			10	1½
Add 15 per cent. profit			1	6½
		Price per 3 ft. run	11	8
		Price per 1 ft. run	3	11

Equal to 11*s.* 9*d.* per foot cube.

Cornice, 18 *in. wide by* 12 *in. deep, Weathered, with Moulding* 18 *in. girth, Rubbed and set in Lime Mortar.*—As before, the length analysed would be 3 ft., and the finished stone would be cut out of the dotted block.

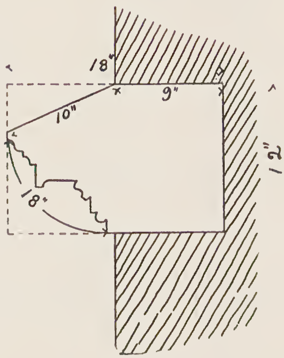

Fig. 27.

			s.	d.
3 . 0 1 . 6 1 . 0	4 . 6	feet cube, Portland stone delivered	9	4½
		Waste, 7½ per cent.	0	8½
		Cartage to site, say	1	1
		Carried forward	11	2

			s.	d.
		Brought forward	11	2
2/3 . 0 0 . 9	4 . 6	Top and bottom beds.		
3 . 0 1 . 0	3 . 0	Back.		
2/1 . 6 1 . 0	3 . 0	Ends or joints.		
	10 . 6	feet super. half-sawing to beds, back, and joints, at 3*d*.	2	7½
3 . 0 0.10	2 . 6	feet super. straight sunk face for weathering, at 1*s*. 4*d*.	3	4
3 . 0 1 . 6	4 . 6	feet super. plain moulded work, at 3*s*.	13	6
3 . 0 0.10	2 . 6	feet super. extra only for plain rubbed work to weathering at 2*d*.	0	5
3 . 0 1 . 6	4 . 6	feet super. extra only for rubbed work to moulding, at 3*d*.	1	1½
		Two mortises for cramps, cutting only, one at each side of joint, at 3*d*.	0	6
	4 . 6	feet cube hoisting and setting up to 30 ft., at 1*d*. per 10 ft. per foot cube	1	1½
Lime mortar, at 7*d*. per foot cube			0	3½
			34	4
Add 15 per cent. profit			5	2
	Price of 3 ft. run		39	6
	Price of 1 ft. run		13	2

Equal to 19*s*. 9*d*. per foot cube.

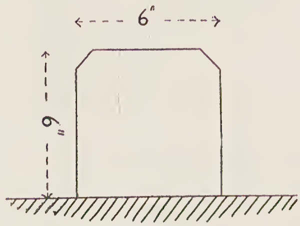

FIG. 28.

Curb, 6 in. by 6 in., rubbed on exposed Faces, including Beds and Joints, double-chamfered, and set in Lime Mortar.

—This includes joints 3 ft. apart, as in previous example. Chamfers are 2 in. wide.

			s.	d.
3 . 0				
0 . 6				
0 . 6	0 . 9	feet cube Portland stone, at 2*s*. 1*d*.	1	7
		Waste, 7½ per cent.	1	1½
2/0 . 6		Cartage to site, say	0	2
0 . 6	0 . 6	Ends or joints.		
3 . 0				
0 . 6	1 . 6	Bed.		
	2 . 0	feet super. half-sawing to bed and joints, at 3*d*.	0	6
3 . 0				
0 . 6	1 . 6	Top.		
2/3 . 0				
0 . 6	3 . 0	Sides.		
	4 . 6	feet super. plain work on exposed faces, at 1*s*.	4	6
	4 . 6	feet super. extra only for rubbing faces, at 2*d*.	0	9
2/3 . 0	6 . 0	feet run chamfer, 2 in. wide, at 3*d*.	1	6
		Mortar and setting	0	2
			10	3½
Add 15 per cent. profit		... ...	1	6½
		Price of 3 ft. run	11	10
		Price of 1 ft. run	4	0

Equal to 16*s*. per foot cube.

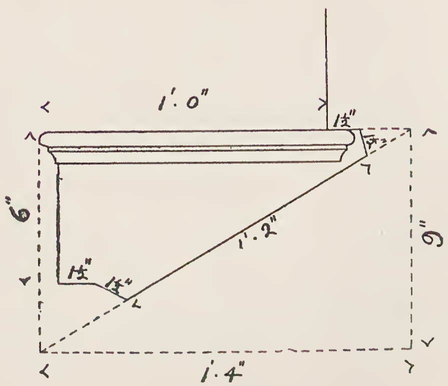

FIG. 29.

Spandrel Step, 5 ft. long by 12 in. by 6 in., moulded and returned, rubbed on exposed Faces, and pinned in Wall in Cement.—As two steps are invariably cut out of one rectangular block, as shown in dotted lines, only the triangular piece of stone would in this case be allowed. The 5 ft. includes the 6 in. portion pinned into the wall, and two mortises for balusters must be allowed at the outside end.

			s.	d.
½/5 . 0				
1 . 4				
0 . 9	2 . 6	feet cube Portland stone, at 2s. 1d.	5	2½
		Waste, 7½ per cent.	0	4
½/1 . 4		Cartage to site, say	0	7
0 . 9	0 . 6	feet super. half-sawing to wall end, at 3d. ...	0	1½
5 . 0				
1 . 1½	5 . 8	Top.		
5 . 0				
1 . 2	5 . 10	Soffit.		
0 . 6				
0 . 6	0 . 3	Front of step pinned into wall.		
	11 . 9	feet super. plain face to top, soffit, &c., at 1s. ...	11	9
3/5 . 0				
0 . 1½	1 . 11	feet super. sunk work in rebates, at 2s.	3	10
1 . 0				
0 . 4	0 . 4	End (average).		
4 . 6				
0 . 6	2 . 3	Riser.		
	2 . 7	feet super. sunk work, stopped, to riser, at 1s. 4d.	3	5
4 . 6				
0 . 4	1 . 6	Front.		
1 . 1½				
0 . 4	0 . 5	End.		
	1 . 11	feet super. moulded work, at 3s.	5	9
4 . 6				
1 . 0	4 . 6	Tread.		
4 . 6				
0 . 4	1 . 6	Riser.		
1 . 0				
0 . 4	0 . 4	End (average).		
	6 . 4	feet super. extra only for plain rubbed work, at 2d.	1	0½
		Carried forward	32	0½

			s.	d.
		Brought forward	32	0½
4 . 6				
0 . 4	1 . 6	Front.		
1 . 1½				
0 . 4	0 . 5	End.		
	1.11	feet super. extra only for rubbed work to moulding, at 3*d.*	0	6
	2 . 6	feet cube hoisting and setting up to 30 ft., at 1*d.* per 10 ft. per F.C.	0	7½
	1	Stopped end to 4 in. moulding	0	2½
	1	Mitre to ditto	0	2
	1	Mitred and returned end to ditto	0	4
	2	Mortises for balusters at 3*d.*	0	6
	1	Step jointed and pinned in wall in cement, 1 hour mason + cement	1	0
			35	4½
Add 15 per cent. profit			5	3½
		Price of each step	40	8

Equal to 8*s.* 2*d.* per foot run.

Square Step, 12 *in. by* 6 *in., rubbed on exposed Faces, and Bedded in Mortar.*—Say 4 ft. long. If this is worked out of stone sawn to scantling sizes, scarcely any labour will be required of the mason. Back jointing extra.

			s.	d.
	4	feet run of 12 in. × 6 in. sawn stone, at 2*s.* 6*d.*	10	0
		Waste, 7½ per cent.	0	4
2/1 . 0		Cartage to site, say	0	6
0 . 6	1 . 0	feet super. half-sawing to ends, at 3*d.*	0	3
4 . 0				
1 . 0	4 . 0	Top.		
4 . 0				
0 . 6	2 . 0	Front.		
	6 . 0	feet super. extra only for rubbed work, at 2*d.* ...	1	0
		Mortar and laying	0	3
			12	4
Add 15 per cent. profit			1	10
		Price of each step	14	2

Equal to 3*s.* 6*d.* per foot run, or 7*s.* per foot cube.

Window Sill, 4 *ft. long by* 12 *in. by* 4 *in., sunk, weathered and throated, grooved for Galvanised Iron Tongue, rubbed,*

including seats for Jambs and Fair Ends, and set in Mortar.—If the seats for jambs were taken separately, the price of each would be 1*s.*, and ditto fair ends 2*d.*

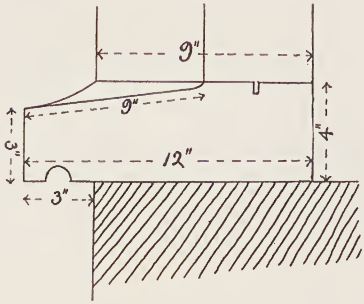

FIG. 30.

4 . 0				
1 . 0			*s.*	*d.*
0 . 4	1 . 4	feet cube Portland stone, at 2*s.* 1*d.*	2	9
		Waste, $7\frac{1}{2}$ per cent.	0	$2\frac{1}{2}$
4 . 0		Cartage to site, say	0	4
0 . 9	3 . 0	Top.		
4 . 0				
1 . 0	4 . 0	Bed.		
4 . 0				
0 . 4	1 . 4	Back.		
2/1 . 0				
0 . 4	0 . 8	Ends.		
	9 . 0	feet super. half-sawing to top, bed, back, and		
4 . 0		ends, at 3*d.*	2	3
0 . 3	1 . 0	feet super. plain face to front edge, at 1*s.* ...	1	0
4 . 0				
0 . 9	3 . 0	feet super. sunk face for weathering, at 1*s.* 4*d.*...	4	0
	2	Mitres or stops to weathering, at 4*d.*	0	8
4 . 0				
0 . 3	1 . 0	Front edge.		
2/0 . 3				
0 . 3	0 . 2	Ends, fair.		
	1 . 2	feet super. extra only for plain rubbed work, at 2*d.*	0	2
		Carried forward	11	$4\frac{1}{2}$

			s.	d.
4 . 0		Brought forward	11	4½
0 . 9	3 . 0	feet super. extra only for sunk rubbed work to weathering, at 2½*d*.	0	7½
2/4 . 0	8 . 0	feet run groove and throat at 1*d*.	0	8
	1 . 4	feet cube hoisting and setting up to 30 ft. ...	0	4
		Mortar for setting	0	2
			13	2
Add 15 per cent. profit		... ...	2	0
		Price of each sill	15	2

Equal to 3*s*. 10*d*. per foot run, or 11*s*. 6*d*. per foot cube.

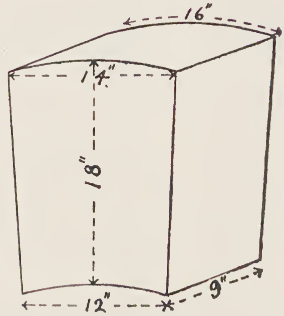

Fig. 31.

Arch Stone, or Voussoir, 14 *in. wide by* 18 *in. long by* 9 *in. deep, rubbed on exposed Faces, and set in Cement.*

			s.	d.
1 . 2 1 . 6 . 9	1 . 4	feet cube Portland stone, at 2*s*. 1*d*.	2	9
		Waste, 7½ per cent.	0	2½
1 . 2		Cartage to site, say	0	4
1 . 6	1 . 9	Back.		
2/ . 9 1 . 6	2 . 3	Joints.		
	4 . 0	feet super. half-sawing to back and joints, at 3*d*.	1	0
1 . 2 1 . 6	1 . 9	,, plain work on face, at 1*s*.	1	9
	1 . 9	,, extra only for plain rubbed work on ditto, at 2*d*.	0	3½
		Carried forward	6	4

			s.	d.
1 . 0		Brought forward	6	4
. 9	. 9	feet super. sunk work, circular, to intrados, at 2s. 1d.	1	7
	. 9	,, extra only for rubbed work on ditto, at 3d.	0	2
1 . 4				
. 9	1 . 0	,, plain work, circular, to top, at 1s. 9d.	1	9
	1 . 4	feet cube hoisting and setting up to 30 ft. ...	0	4
		Cement for setting	0	3
			10	5
Add 15 per cent. profit		... ...	1	7
		Price of each voussoir	12	0

Equal to 9s. per foot cube.

Mortise for Baluster and run with Lead.—Each hole would be about 1 in. square, and would not exceed 3 cubic inches.

	s.	d.
Cutting mortise, ¼ hour mason at 10½d.	0	2½
Lead, ¾ lb. at 3d.	0	2¼
Fuel for lead	0	0¼
Labour in running	0	0½
	0	5¼
Add profit	0	0¾
Price of each	0	6

Sharpening Tools.—In reckoning the value of labour the cost of sharpening the mason's tools should not be overlooked. For this a smith may be paid 6*d.* per score, and the amount of sharpening depends upon the hardness of the stone. In some shops the masons do it themselves, but it is only a matter of convenience, and nothing is saved.

Machine Work.—The following example from Powis Bale's *Stone-Working Machinery*, 1898, is instructive :—"Moulded work on white Portland stone steps, 5 ft. × 7 in. deep, with a moulding 12 in. girth. Eighteen steps were machine-moulded per day = 90 ft. super. of moulding. The cost of a day's work was—

	£	s.	d.
2 labourers working machine, one day each = 20 hrs. at 5½d.	0	9	2
Steel tools, making and sharpening at 45s. per week = 7s. 6d. per day	0	7	6
Steam power, say	0	5	0
Interest upon outlay at 5 per cent., say	0	3	6
Total machine-working 90 ft. super. of moulding 90)	1	5	2
,, ,, 1 ,, ,, ,,	0	0	3¼

As hand labour of above would cost 1*s*. 2*d*. per ft. super., the saving by machine-working would be 1*s*. 2*d*. less $3\frac{1}{4}d. = 10\frac{3}{4}d.$ per ft. super." Mr. Powis Bale says £1 5*s*. 2*d*. is low, and £1 10*s*. would be nearer the mark, especially as wages are higher.

"With a steam lathe 42 granite columns (of all sizes above 8 in. diameter) representing 1,100 ft. super., can be turned in 383 hours; whereas one mason would have spent 4,428 hours in doing the same work."

Yorkshire Stone.

York stone, mostly from the neighbourhood of Bradford, is employed for pavings, landings, hearths, steps, templates, and in such situations where wear and hardness are required. It is customary with this stone to combine material and labour in one item, instead of treating them separately, as with Portland and other stones. This is because it is generally tooled or sawn at the quarry, being invariably used for work of a plain character, and only slightly rubbed or further finished at the site.

The cost of York stone delivered in London within four miles can readily be obtained from a stone merchant. If cut to sizes add $1\frac{1}{2}d.$ per foot super.

Examples.

Two-inch York Stone Paving, rubbed, jointed, and laid in Mortar.—The stones are presumed to be in random sizes, with meeting joints squared.

	s.	d.
1 ft. super. 2 in. tooled paving, delivered	0	$6\frac{3}{4}$
Waste, 10 per cent.	0	$0\frac{3}{4}$
Slightly rubbing and finishing one side	0	2
Laying in mortar and jointing	0	3
	1	$0\frac{1}{2}$
Add 15 per cent. profit	0	$1\frac{1}{2}$
Price per foot super.	1	2

Two-inch York Stone Hearth, rubbed, jointed, and laid in Mortar.—This would be cut to size out of sawn stone because

of the length, and slightly rubbed and finished on face afterwards.

	s.	d.
1 ft. super. 2 in. sawn hearth stone delivered	0	$9\frac{1}{2}$
Cutting to size	0	$1\frac{1}{2}$
Waste, 5 per cent.	0	$0\frac{1}{2}$
Slightly rubbing and finishing one side	0	2
Laying in mortar and jointing	0	3
	1	$4\frac{1}{2}$
Add 15 per cent. profit	0	$1\frac{1}{2}$
Price per foot super.	1	6

Notches in Hearths for Jambs.—This would be equal to $\frac{1}{2}$ hour mason at $10\frac{1}{2}d.$, plus profit $= 6d.$ each.

Examples of York stone per cubic foot are taken in precisely the same manner as those for Portland.

Edges, coped or sawn, are calculated thus :—

				Per ft. run. s.	d.
On York stone	2 in. thick	·15	hour mason at $10\frac{1}{2}d.$	= 0	$1\frac{1}{2}$
,,	$2\frac{1}{2}$ in. ,,	·18	,, ,, ,,	= 0	$1\frac{3}{4}$
,,	3 in. ,,	·25	,, ,, ,,	= 0	$2\frac{1}{2}$
,,	4 in. ,,	·30	,, ,, ,,	= 0	3

If circular, add one-half to the above rates ; and if sunk circular, the above rates to be doubled.

Granite.

A mason and labourer can set $2\frac{1}{2}$ ft. cube per hour of granite bases to C.I. columns ; labour only.

A mason will cut a $1\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by 2 in. hole in a granite step for an iron baluster in $\frac{3}{4}$ hour.

A mason can cut 1 ft. run of raglet, $\frac{3}{4}$ in. deep, per hour in granite.

Marble Mason.

Marble is only used for such fittings as lavatory and counter-tops, steps, chimneypieces, and wall linings ; it is nearly always employed in the shape of slabs as veneering. The sanitary manufacturer prefers to supply his own lavatory tops, in which case they will be more expensive than if supplied by a marble merchant independently. Sicilian marble is much the commonest and cheapest. It comes from Carrara, near Leghorn, Italy, where at present 611 quarries are being worked. Marina, the port of export, is only six miles away, being connected by a railway.

CHAPTER X.—PAVIOR.

MEMORANDA.

One ton of—

3¼ in.	by 3¼ in.	by 3¼ in.	granite	cubes	will cover	6 7/10	sq. yds.
3½ in.	by 3½ in.	by 3½ in.	,,	,,	,,	6⅕	,,
4 in.	by 4 in.	by 4 in.	,,	,,	,,	5⅕	,,
4 in.	by 3 in.	by 3 in.	,,	setts	,,	5⅖	,,
4 in.	by 4 in.	by 3 in.	,,	,,	,,	5⅓	,,
4 in.	by 4 in.	by 6 in.	,,	,,	,,	3⅗	,,
5 in.	by 3 in.	by 3 in.	,,	,,	,,	4⅖	,,
6 in.	by 3 in.	by 3 in.	,,	,,	,,	3 7/10	,,
7 in.	by 3 in.	by 3 in.	,,	,,	,,	3	,,

Aberdeen granite weighs 166 lb. per foot cube, or 1 ton equals 13½ ft. cube. A load of granite setts or metalling equals 1½ ton.

1 ton of ragstone will cover 5 to 5½ square yards.
1 ton of pebble paving will cover 4 to 6 square yards.

Val de Travers Asphalte.—Hexagonal blocks, 6¼ in. sides × 6¾ in. thick, weighing 58 lb. each.

1 in. asphalte,		without grit,	weighs	9¼ lb.	per foot super.
,,	,,	coarse gritted,	,,	12¼ lb.	,, ,,
,,	,,	fine gritted,	,,	13 lb.	,, ,,

French Co.'s Asphalte.—Blocks are round, branded with crossed stirrers, weighing about 56 lb. each.

7½	blocks	cover	100 ft. super.,	⅜ in.	thick.
9	,,	,,	,,	½ in.	,,
15	,,	,,	,,	¾ in.	,,

The blocks are broken up in a cauldron and fluxed with 5 per cent. refined bitumen, and when thoroughly cooked, the asphalte is spread to required thickness with a hand float. Grit is mixed with the fine asphalte for most purposes.

There are, roundly speaking, seven different kinds of paving—brick paving, tile paving, stone paving, asphalte and tar paving, granite paving, pebble paving, and wood-block paving. The first two have been included under "Bricklayer," the third under "Mason," while the remainder belong to the Pavior proper. Asphalte, tar, and wood-block pavings are almost always carried out by the specialist.

PRICES.

Asphalte Paving.

The cost of asphalte pavings is greatly dependent upon the quantity required, distance, &c., so that special quotations should always be obtained. The charge for work in the country is generally about 5 per cent. more than in London; but this may run up to over 30 per cent. in remote places in Ireland. The following rates of specialist firms include laying in London within the four-mile radius, but are exclusive of digging or of concrete foundation.

		s.	d.
Val de Travers asphalte, ¾ in. paving	per yd. sup.	5	6
,, ,, ,, 1 in. ,, ...	,,	6	6
,, ,, ,, flooring mastic	per cwt.	3	9
,, ,, ,, roofing mastic	,,	4	6
,, ,, ,, bitumen for fluxing ...	,,	9	6
,, ,, ,, spreaders or layers ...	per hour	0	10
,, ,, ,, cauldron men	,,	0	8
French Co.'s Seyssel asphalte, gritted, ¾ in. thick ...	per yd. sup.	5	3
,, ,, ,, damp course, ½ in. thick	,,	4	0
,, ,, ,, vertical ditto, three coats	,,	10	0
,, ,, ,, skirting, including fillet	per ft. run	1	6
,, ,, ,, channel (labour only)...	,,	0	4
,, ,, ,, stable flooring, 1½ in. thick	per yd. sup.	8	6
,, ,, ,, in blocks	per ton	105	0
Concrete under asphalte (1 of Portland cement, 1 sand, and 6 ballast), laid by company	per yd. cube	13	0
Hoisting ditto, for every 10 ft. above ground level...	,,	0	6
Extra, forming gutters in concrete	per ft. run	0	4
Cartage (including filling and emptying the carts), not exceeding 1 furlong	per load or ton	1	0
Ditto, for each additional distance not exceeding 1 furlong	,,	0	2
Asphalte mastic, flooring	per cwt.	3	9
,, ,, roofing	,,	4	6
Fuel for last	,,	1	3
Mineral tar for ditto	,,	10	0
Grit for ditto	,,	1	0
Use of cauldron and utensils per day of nine hours	per set	2	0
Cauldron men per day of nine hours	each	6	0
Spreaders, ditto, ditto	,,	7	6
Taking up old asphalte	per ft. sup.	0	0½
Materials only for ¾ in. work	,,	0	7
Heating edge of old asphalte to form joint between old and new work	per ft. run	0	1

Tar Paving.

		s.	d.
2½ in. best tar-paving, made with broken limestone, ½ in. to 1½ in. cube, in three layers ...	per yd. sup.	2	6
3 in. tar-paving, ditto	,,	2	8
4 in. tar-paving, ditto	,,	3	3

Granite Paving.

Laid in screened gravel, including the gravel, forming and ramming the ground, but exclusive of digging or of concrete foundation.

New Aberdeen or Guernsey Granite Paving.	5 in. deep.		6 in. deep.		7 in. deep.		8 in. deep.		9 in. deep.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Paving properly squared on the face and joints, and laid complete per yd. sup.	8	6	9	9	11	3	13	0	15	0
Paving in parallel courses, not exceeding 5 in. in width on face, and laid complete per yd. sup.	9	6	11	6	14	0	15	6	17	0
Ditto, not exceeding 3 in. ditto, and ditto per yd. sup.	14	6	17	0	19	6	22	0	26	0
Taking up paving and clearing the space per yd. sup.	0	2	0	2½	0	2½	0	3	0	3½
Add to last if stacked ,, ,,	0	1	0	1	0	1	0	1	0	1
Taking up paving and relaying ... per yd. sup.	1	3	1	4	1	5	1	6	1	7
Re-dress old paving ,, ,,	2	6	2	9	3	0	3	3	3	6
Add if half Portland cement and half sand are used in laying, grouting, and jointing per yd. sup.	2	6	2	6	2	6	2	6	2	6
Cutting edges, splay or circular, including waste ... ... per ft. run	0	4	0	5	0	6	0	7	0	8

		s.	*d.*
Add to foregoing paving if in gutters or channels when separate or detached from similar paving, or in widths under 2 ft....	per yd. sup.	0	4
Raking out joints of old pitcher paving for grouting	,,	0	6
Grouting to new or old pitcher paving with 1 of hydraulic lime to 2 of sand...	,,	0	5
Add to last if grouted with 1 of Portland cement to 2 of sand	,,	0	9
5 in. by 10 in. Cornish granite curb, set complete	per ft. run	2	0
6 in. by 10 in. ,, ,, ...	,,	2	3
5 in. by 12 in. ,, ,, ...	,,	2	3
6 in. by 12 in. ,, ,, ...	,,	2	6
Add for circular	,,	0	3
Taking up and resetting curb	,,	0	5
Granite channels, stones 5 in. wide and 7 in. deep, laid	,,	1	3

Guernsey granite setts delivered alongside in barges at wharves below Chelsea.

		s.	*d.*
3 in. by 5 in.	per ton	32	0
3 in. by 6 in.	,,	30	0

GRANITE PAVING—*continued.*

		s.	*d.*
3 in. by 7 in.	per ton	28	0
4 in. by 7 in.	,,	25	0
4 in. by 9 in.	,,	23	0
5 in. by 7 in.	,,	23	0

To the price of setts and curbs add 6*d.* per ton for landing, and the cartage according to distance, assuming a cartload at 1½ ton.

PEBBLE PAVING.

Paving and laid in screened gravel, including forming the ground.

		s.	*d.*
Paving with hard pebbles, averaging 3 in. in diameter, of uniform size, and bedded endwise in the gravel	per yd. sup.	4	4
Taking up ditto, and clearing the space	,,	0	3
Ditto, and removing and stacking where directed, not exceeding 100 yds.	,,	0	5
Selecting and relaying ditto in gravel	,,	1	0
Grouting to old or new pebble paving with 1 of hydraulic lime to 2 of sand	,,	0	6
Add to last if grouted with 1 of Portland cement to 2 of sand	,,	0	6
Paving pebbles, new, delivered	per ton	15	0

WOOD-BLOCK PAVING.

		s.	*d.*
Wood paving of 9 in. by 3 in. by 6 in. red deal blocks, grouted with cement, and laid on 6 in. concrete	per yd. sup.	12	2
Ditto, creosoted, jointed with bitumen, and top-dressed with fine sand, laid on 6 in. concrete, inclusive as laid by the Improved Wood Pavement Co.	,,	11	0
Wood paving in blocks of good sound Baltic fir, 6 in. cubes, pitch and cement joints, end grain uppermost, including trimming blocks, preparing ground, but exclusive of concrete foundation ...	,,	11	5
Ditto, ditto, and creosoted	,,	13	8
Ditto, ditto, laying only	,,	0	8
Add if joints are run in with hot pitch or bitumen	,,	0	7
Taking up and removing old wood paving	,,	0	2½
6 in. Portland cement concrete bed for foregoing ...	,,	2	9

ROAD-MAKING, &c.

		s.	*d.*
1½ in. Val de Travers compressed asphalte roadway	per yd. sup.	10	6
6 in. concrete foundation for ditto, laid by company	,,	2	6
Ordinary macadamised road, laid with granite metal 9 in. deep	,,	7	0
Cost of binding material for ditto	,,	0	5
Steam rolling on roads	,,	0	1
Picking up to a depth of 1 in., and levelling for stones, &c.	,,	0	0¾

Road-Making, &c.—*continued.*

		s.	d.
Picking up to a depth of 3 in., and levelling for stones, &c.	per yd. sup.	0	1½
Spreading and levelling broken stone, brick gravel, &c., from 1 in. to 3 in. thick	,,	0	0⅝
Ditto, 3 in. to 6 in. thick, and ditto	,,	0	1
Spreading and levelling metalling in 6-in. layers ...	per yd. cube	0	2
Ditto and rolling	,,	0	3¾
Screening gravel, &c., the whole quantity to be measured	,,	0	6
Breaking old bricks into 2-in. cubes, hand labour only	,,	1	4
Breaking Kentish rag or limestone ditto	,,	2	9
Ditto, machine labour only	,,	1	0
Breaking old granite, flint, or pebbles to 2-in. gauge, hand labour only	,,	3	0
Ditto, 1½ in. gauge, ditto	,,	3	6

(Hand-broken stone is more durable than machine-broken for roads. All thickness of broken stone, gravel, &c., spread on surfaces to be calculated by aliquot parts of a measured cubic yard. Thus a yard cube of broken stone or gravel is estimated to cover 12 yds. super., 3 in. in thickness.)

Broken slag	per yd. cube	14	0
Broken Kentish ragstone, delivered on site, 1½-in. gauge	,,	12	6
Ditto, 2-in. gauge	,,	12	0
Stone, broken to 2-in. gauge	,,	9	0
Rubbish, hard dry, or broken bricks	,,	3	10
Granite siftings, Mount Sorrel, or other approved ...	,,	16	6
Aberdeen or Guernsey granite, spalls or rubble ...	,,	14	6
Aberdeen or Guernsey granite, broken to 1½-in. gauge	,,	17	6
Ditto, 2-in. gauge	,,	17	0
Flints, broken to 1½-in. gauge	,,	9	6
Ditto, 2-in. gauge	,,	9	0
Ditto, faced for paving and properly dressed ...	,,	9	6
Throwing broken stone from barge into cart (15 yds. thrown per day by labourer)	,,	0	4

Materials.

(supplied only.)

Cement, Portland	per bushel	1	10
Gravel, clean, unscreened, best local...	per yd. cube	4	6
,, coarse screened, or clean fresh water ballast	,,	6	6
,, fine screened, good binding gravel, for paths	,,	8	0
Lime, unslaked, ground fine, lias	per bushel	0	10
Sand, pit or river, clean sharp, unwashed	per yd. cube	6	9
,, ,, ,, washed	,,	10	0
,, ,, washing, labour only	,,	1	7
,, ,, screening, labour only	,,	0	6½
Shingle, clean	,,	7	6
Coal tar	per gallon	0	4
Creosote oil, in barrels	,,	0	3
Coal-tar pitch, in blocks	per ton	40	0
Stockholm tar, per barrel of 28 gallons	per barrel	32	0

Breaking Stone.—The following table gives the cost of breaking stone, bricks, &c., by hand. If broken in large quantities by steam power deduct 20 per cent.

Description.	¾ in. Cube.	1½ in. Cube.	2 in. Cube.
	s. d.	*s. d.*	*s. d.*
Granite	7 6	4 0	3 9
Kentish Rag	6 6	3 6	2 9
Flints or Pebbles	5 6	3 3	2 6
Bricks	4 6	3 0	1 4

		s. d.
Wages, pavior's	per hour	0 10
,, labourer's	,,	0 6½

ANALYSIS.

Asphalte Paving.

Val de Travers Asphalte.—The blocks are of hexagonal shape, and weigh ½ cwt. each. When about to be used these blocks are broken up into small pieces and melted in a cauldron, 1 lb. of mineral tar being added for fluxing every cwt. of asphalte (2 lb. of mineral tar having first been put in for greasing).

The cauldrons or pots generally hold 6 cwt. of asphalte each, and require to melt this about 1 cwt. of coal as fuel. Two spreaders, 2 attendants, and 1 cauldron man will work 2 pots and empty them three times a day of 10 hours, equivalent to 6 pots in all, the fires being lighted at 4 a.m. by the cauldron man, so as to be ready for the spreaders at 6 a.m.

A pot of asphalte will cover 7 yds. super. of flooring ¾ in. thick. The analysis would therefore appear :—

	s. d.	*s. d.*
1 pot, or 6 cwt., of asphalte at 3*s*. 9*d*. per cwt.		22 6
7 lb. (2 lb. + 5 lb.) = $\frac{7}{112}$ cwt. mineral tar, or bitumen, at 9*s*. 6*d*. per cwt.		0 7
1 cwt. fuel (steam coal) at 1*s*. 6*d*.		1 6
Cost of materials per pot		24 7
2 spreaders per day, at 8*s*. 6*d*. each	17 0	
2 attendants ,, 6*s*. 6*d*. ,, ...	13 0	
1 cauldron man ,, 6*s*. 6*d*. ,, ...	6 6	
2 hours extra time of cauldron man between 4 and 6 a.m. at 8*d*.	1 4	
Carried forward	37 10	24 7

	s.	d.	s.	d.
Brought forward	37	10	24	7
Use of plant, *i.e.*, use of 2 pots 1 day at 2*s.* each ...	4	0		
Labour working 6 pots	6)41	10		
Labour working 1 pot			7	0
Total cost of 1 pot covering 7 yd. super.			31	7
Add 5 per cent. contingencies for weather, stoppages, &c.			1	7
			33	2
Add 15 per cent. for profit, supervision, &c.			5	0
Total price of 7 yds. super.			7)38	2
Total price per yd. super.			5	5½

Say 5*s.* 6*d.* per yd. super., which agrees with the price given on page 170. The establishment charges are already contained in the cost of materials when manufactured.

Granite Paving.

A pavior (10*d.*) and labourer (6½*d.*) will lay, including gravelling the bed and grouting, granite setts 5 in. deep and under, 11 yards super. per day of 9 hours (10*d.* + 6½*d.* = 1*s.* 4½*d.* × 9 hours = 12*s.* 6*d.* ÷ 11) 1*s.* 1½*d.* per y.s.

Ditto setts 5 in. to 7 in. 10 yards super. ditto = 1*s.* 3*d.* per y.s.
Ditto setts 7 in. to 9 in. 9 yards super. ditto = 1*s.* 3¾*d.* per y.s.

3 *in. by* 7 *in. deep Granite Setts, and laid complete in Parallel Courses.*—One ton of these setts would cover about 3 sq. yds.; therefore ⅓ ton covers 1 sq. yd.

	s.	d.
⅓ ton granite setts at 28*s.* per ton at wharf	9	4
⅓ ton for landing ditto at 6*d.*	0	2
⅕ load cartage at 5*s.* per load of 1½ ton within 4 miles radius ...	1	0
$\frac{1}{15}$ yard cube of coarse-screened gravel at 6*s.* 6*d.*	0	5
Labour for foregoing, 12*s.* 6*d.* ÷ 10	1	3
	12	2
Add 15 per cent. profit	1	10
Price per yard super.	14	0

Pebble Paving.

One ton of pebbles will cover from 4 to 6 sq. yds., according to size and mode of laying. Assume, however, that 1 ton of 3-in. pebbles buried endwise in gravel will cover 6 sq. yds., or one-sixth ton to the yard super. A pavior

and labourer will lay 20 yds. a day, or half an hour for each yard. Add gravel, and for labour forming ground.

	s.	d.
Labour forming ground	0	2
$\frac{1}{6}$ ton of 3-in. pebbles at 15*s.* per ton	2	6
Gravel for bedding, say $\frac{1}{10}$th yard cube at 4*s.* 6*d.*...	0	$5\frac{1}{2}$
Labour laying, $\frac{1}{2}$ hour pavior (10*d.*) and labourer ($6\frac{1}{2}$*d.*) at 1*s.* $4\frac{1}{2}$*d.*	0	$8\frac{1}{4}$
	3	$9\frac{3}{4}$
Add 15 per cent. profit	0	$6\frac{1}{4}$
Price per yard super.	4	4

Wood-block Paving.

Wood Paving of 9 *in. by* 3 *in. by* 6 *in. Red Deal Blocks, grouted with Cement, and laid on* 6 *in. Concrete.*—Blocks of this—the commonest—size cost £6 10*s.* per 1,000 delivered in London, and with $\frac{3}{8}$ in. joints there would be 40 to the square yard. A pavior and labourer would lay 10 yds. per day, including grouting and top-dressing, or 1 yd. per hour.

	s.	d.
Labour forming ground	0	3
6 in. Portland cement concrete foundation and laid	2	9
40 wood blocks at £6 10*s.* per 1,000	5	$2\frac{1}{2}$
Half-bushel Portland cement for grouting ditto at 1*s.* 10*d.* ...	0	11
Sand for top-dressing blocks at 6*s.* 9*d.* per yard cube	0	1
Labour laying blocks, including grouting and top-dressing, 1 hour pavior and labourer at 1*s.* $4\frac{1}{2}$*d.*	1	$4\frac{1}{2}$
	10	7
Add 15 per cent. profit, say	1	7
Price per yard super.	12	2

Road-making, &c.

Average Cost.—In England the cost per mile per annum of urban roads has been calculated at £140, that of rural roads at £56, and that of lanes and by-roads at £28. Other authorities have worked out the average cost of English main roads at £100 per mile.

In Ireland the annual cost amounts to an average of only £14 per mile.

Where traffic is considerable, the width of roads has such an important influence upon cost, that it is better to compare the cost per yard super. rather than the cost per mile. Thus, in Brighton, Norwich, and Liverpool the cost of maintenance of the macadam streets averages 1*s.* 7*d.* per yard super. In

London, Parliament Street and Regent Street cost 3*s.* 7*d.* per yard super. for maintenance.

The borough surveyor's report of the cost of re-coating Railway Street, Wolverhampton, may be useful:—

	£	s.	d.
Stocking (*i.e.*, "lifting" the roadway).—12 days at 3*s.* 2*d.* ...	1	18	0
Stone.—158 tons, at 5*s.* 9*d.*	45	8	6
Horse hire, 15 days at 8*s.*	6	0	0
Labour spreading, 6¼ days at 3*s.* 8*d.*	1	2	11
Sand.—43 tons	3	18	6
Horse hire, 6½ days at 8*s.*	2	12	0
Labour spreading, 6¼ days at 3*s.* 7*d.*	1	1	4
Water.—Horse hire, 3 days at 8*s.* (5,800 gallons used) ...	1	4	0
Steam Rolling.—3 days at 10*s.*	1	10	0
Driver, 3 days at 5*s.*	0	15	0
Flagman, 3 days at 3*s.* 4*d.*	0	10	0
Coke, oil, &c.	0	9	6
Total cost for 1,422 yards super.	66	9	9
Price per yard super.	0	0	11¼

This cost of 11¼*d.* per square yard is therefore approximately made up as follows :—

	s.	d.
Stocking	0	0½
Stone	0	8¼
Sand	0	1¼
Watering	0	0¼
Rolling	0	0½

It will be noticed that this is the cost incidental to remetalling only, and does not include cleansing and other details. To this must be added, therefore, the cost of supervision, which usually amounts to between 5 and 6 per cent. of the total expenditure, and the cost of sweeping, scraping, watering, and small repairs necessary to maintain the road in good condition.

Steam Rolling.—It is difficult to lay down any fixed rule as to the cost of steam rolling, since the quantity of work which can be done in a given time varies with the number of stoppages necessary and other uncertain factors. It is found that in Nottinghamshire an average of 30 tons of broken stone can be rolled in one day; but this quantity will vary with the weight of the roller, the quality of the stone, the thickness of the coating, and the area of the patches. Large patches are rolled more quickly than small ones, owing to the smaller number of stoppages necessary in the former case.

In comparing the estimates of cost of steam rolling also, different surveyors make up the total in various ways. Some include only the wages of the driver and the actual cost of working the roller, while others include the wages of the additional men required for spreading, binding, watering, and sweeping.

The following may be taken as an average example of the cost of rolling 165,329 yards super. of road, covered with 9,132 cubic yards of mountain limestone and chert:—

	£	s.	d.
Engine-driver	63	6	6
Sweepers	78	6	4
Horse hire	124	9	0
Coal	54	9	0
Oil and sundries	32	9	0
Depreciation and repairs to roller, 20 per cent.	81	16	3
Total	£434	16	1

This amount works out at 11½*d.* per cubic yard of stone, or a little more than ½*d.* per superficial yard.

The work per day of a 15-ton steam roller may be analysed as follows:—

	s.	d.
15 cwt. of coke for fuel at 11*d.* per cwt.	13	9
Oil and tallow	1	0
Allow for depreciation and repairs, say	4	5
Ten hours stoker at 7*d.* per hour	5	10
Ten hours labourer with flag at 6*d.* per hour	5	0
Two labourers spreading sand, 20 hours at 6*d.*	10	0
Two men watering and sweeping, ditto	10	0
Cost of working	50	0

The average quantity rolled per day may be taken at 800 yards super., and thus the cost of one yard would be:—

	s.	d.
Steam-rolling by 15-ton steam-roller, 50*s.* ÷ 800 = ...	0	0¾
Add profit, say	0	0¼
Price per yard super.	0	1

A usual charge for a roller, men, and fuel is 25*s.* to 30*s.* per day.

Picking up to a depth of 3 *in., and Levelling for Stones, &c.*—A labourer at 6½*d.* per hour will do 40 yards super. of this per day of 9 hours; therefore 6½*d.* × 9 hours = 5*s.* ÷ 40 yards = 1½*d.* per yard super.

Spreading and Levelling Metalling in 6-*in. Layers.*—A labourer will spread 30 cubic yards of metalling in 6-in.

layers per day. Therefore, $6\frac{1}{2}d. \times 9$ hours $= 5s. \div 30$ cubic yards $= 2d.$ per yard cube. This is equal to $\frac{1}{2}d.$ per yard super. with profit.

A cubic yard of ordinary road-metal 1 in. thick theoretically covers 36 square yards of surface, but practically 30 yards. 55 per cent. of ordinary road metal is solid.

Tar Macadam.—The cost of tar macadam as usually laid down for roadways varies somewhat with the amount of preparation of the ground that may be necessary. Where the foundation is already made, as in the case of old paved roads, the only preparation required is stripping and making good any weak places that may occur in the existing foundation; but when new ground is to be covered, the cost of preparing a foundation may be considerable, and often adds as much as 30 per cent. to the total cost.

The actual cost of tar macadam as laid in Canterbury proved to be as below. In the first place the materials required for making 40 cubic yards of macadam amounted to 9*s.* 2*d.* per cubic yard, as shown by the accompanying items :—

MATERIALS PER YARD CUBE.

	£	s.	d.
45 cubic yards of pit gravel at 3*s.* 6*d.*	7	17	6
79 gallons of tar at $2\frac{1}{2}d.$ per gallon	0	16	$5\frac{1}{2}$
234 lb. of pitch at 46*s.* 8*d.* per ton	0	4	$10\frac{1}{2}$
84 bushels of coke at 9*s.* 4*d.* per chaldron	1	1	$9\frac{1}{2}$
30 bushels of breeze	0	8	0
Wages for preparing and mixing	7	18	7
Materials for 40 yards cube	18	7	$2\frac{1}{2}$
Material for 1 yard cube	0	9	2

This mixture, costing 9*s.* 2*d.* per cubic yard, is laid to a thickness, when compressed, of about 4 in.; so that the cost of materials for coating one superficial yard 4 in. thick (being $\frac{1}{9}$th of a yard cube) will amount to 1*s.* 6*d.* The cost of laying will include the following items :—

COST PER YARD SUPER.

	s.	d.
Cost of mixture only	1	6
Stripping road 8 in. thick	0	9
Broken brick ballasting	0	10
Applying tar macadam in three layers and finishing	0	9
Rolling	0	3
Sundries, 10 per cent.	0	5
Laying per yard super.	4	6

The life of such a pavement being taken at seven years, and cost of annual repairs at 2*d*. per yard, the whole cost amounts to less than 10*d*. per annum per yard super., and will be much less if the cost of stripping and foundation be deducted. In Croydon, where the old road foundation was not disturbed, and some of the old road metal was utilised for the lower layer of tar macadam, the total cost was about 3*s*. 6*d*. per square yard when laid down 8 in. in thickness.

CHAPTER XI.—SLATER.

MEMORANDA.

Names.	Size.	Gauge for 3 in. Lap nailed in centre.	Gauge for 3 in. Lap nailed 1 in. from head.	No. of Squares covered by 1,200.	Weight of 1,200, First Quality.	No. required to cover one Square at 3 in. Lap.	Weight per Square, First Quality.	Nails required per Square. Iron.	Nails required per Square. Copper.
	in.	in.	in.		cwt.		cwt.	No.	lbs.
Singles	12× 8	4½	4	3·0	18	400	6	800	5
Doubles	13× 6	5	4½	2·5	15	480	6	960	6
Ladies	16× 8	6½	6	4·5	25	266	5½	532	3½
Viscountesses ...	18×10	7½	7	6·2	35	192	6½	384	2¾
Countesses	20×10	8½	8	7·0	40	170	5⅔	340	4
Marchionesses	22×11	9½	9	8·7	50	138	5¾	276	3¼
Duchesses	24×12	10½	10	10·4	60	115	5¾	230	3
Princesses	24×14	10½	10	12·2	70	98	5⅔	196	3
Empresses	26×16	11½	11	15·2	95	79	6¼	158	3½
				A.					
Imperials	30×24	13½	—	2·5	—	36	8	72	3
Rags	36×24	16½	—	2·2	—	25	9	50	3½
Queens	36×24	16½	—	2·2	—	25	9	50	3½

A.—Squares covered by 1 ton.

The above sizes sometimes slightly vary, according to the quarry.

Slates are classed according to their straightness, smoothness of surface, fair even thickness, presence or absence of discoloration, &c. They are generally divided into first and second qualities, and in some cases a medium quality is quoted. Slates of first quality are thinner and lighter than those of inferior quality.

Rule to find the number of slates required to cover one square:—One square in inches ÷ width of slate in inches × gauge in inches.

The weight of slating on roofs is 8 lb. per foot super. for

all sizes, except rags or queens, including a 3-in. lap and nails.

As there are two nails per slate, the number required per square will be found by doubling the number of slates. The trade "Thousand," or "long tally," equals 1,200 for buying and selling, and the trade "Hundred" equals 120 ditto.

Slate Slabs.

300	ft. super.	½	in. thick, weigh	1 ton	and	1 ft. super.	weighs	7½	lb.
200	,, ,,	¾	,,	,,	,,	,,	,,	11⅕	,,
150	,, ,,	1	,,	,,	,,	,,	,,	15	,,
120	,, ,,	1¼	,,	,,	,,	,,	,,	18⅔	,,
100	,, ,,	1½	,,	,,	,,	,,	,,	22⅖	,,
75	,, ,,	2	,,	,,	,,	,,	,,	30	,,

PRICES.

These slates to be of best Bangor, or others of equal quality or value, with 3-in. lap, and two nails to each slate.

		s.	d.
Ladies laid complete (exclusive of boarding and battening), with composition nails	per square	40	0
Countess, ditto ditto	,,	45	0
Duchess, ditto ditto	,,	42	0
Add to foregoing if more than 3 in. lap be ordered, for every ½ in. beyond the 3 in.	,,	2	0
Add to slating if drilled and countersunk	,,	1	6
Add for torching, or pointing on the underside with hair mortar when laid on laths or open battens ...	,,	2	10
Ditto if plastered one coat with lime and hair mortar against underside	,,	6	0
Slating of any kind, stripped and piled at the foot of the building, or in store, including removal of old battens	,,	2	6
Old slating dressed and relaid complete, with iron nails (labour and nails only)	,,	9	0
Slate damp-proof course of Countess or Duchess slates, set in cement, double course, breaking joint ...	per ft. sup.	0	6
Filleting with hair mortar	per ft. run	0	1½
,, with Portland cement	,,	0	2
Ridge or hip tile, 7-in. wings, plain dead joints, terro-metallic blue, red, or buff, set in hair mortar and pointed with cement	,,	0	8
Ditto with raised roll, and ditto	,,	0	11
Add to last two items if set in cement	,,	0	2
"Thomas's" patent ridge, 1⅝-in. roll, with 5-in. wings and set in cement	,,	2	4
"Williams's" patent slate ridge, with copper dowels and screws, 3-in. roll and 7-in. sides, in lengths of not less than 4 ft., supplied only	,,	1	10
Add if fixed, including bedding in hair mortar and pointing with cement	,,	0	4
Extra for cutting slating to hips, valleys, and waste ...	,,	0	2
,, ,, ,, to eaves ditto...	,,	0	3
Galvanised iron hip hooks and fixed	each	1	6
Make good slating to pipe passing through roof ...	,,	2	0

Slate Masonry.

Slate fittings to shelves, lavatories, urinals, cisterns, &c., of Bangor or other of equal quality, sawn or cut to any size required.

Description.	Thickness.					
	$\frac{3}{4}$ in.		1 in.		$1\frac{1}{4}$ in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Slabs, quarry planed or self faced (obtained by splitting), under $16\frac{1}{2}$ ft. super., supplied only.......................... per ft. sup.	0	11	1	1	1	3
Ditto, from $16\frac{1}{2}$ to 30 ft. super., supplied only .... per ft. sup.	1	0	1	$3\frac{1}{2}$	1	6
Setting slate slabs of any size in mortar per ft. sup.	0	2	0	2	0	2
Add to last if bedded in Portland cement ,,	0	2	0	2	0	2
Add to first two items if fixed, including drilling and countersinking ...... per ft. sup.	0	2	0	$2\frac{1}{2}$	0	3
Add to slabs if planed and edges jointed, for each side .... per ft. sup.	0	1	0	$1\frac{1}{4}$	0	$1\frac{1}{2}$
Add to last if finely rubbed, and ditto ,,	0	2	0	2	0	2
Add if enamelled each side, white or green ,,	1	4	1	4	1	4
Enamelling plain edges, white or green per ft. run	0	$3\frac{1}{2}$	0	4	0	$4\frac{1}{2}$
Chamfering from 1 in. to 2 in. wide and rubbing .... ,,	0	$1\frac{3}{4}$	0	$1\frac{3}{4}$	0	$1\frac{3}{4}$
Ditto, ditto, circular....................... ,,	0	3	0	3	0	3
Circular cutting............................ ,,	0	$2\frac{1}{2}$	0	4	0	$4\frac{1}{2}$
Edges sawn................................. ,,	0	$1\frac{1}{4}$	0	$1\frac{1}{2}$	0	2
,, filed .... ,,	0	$1\frac{1}{2}$	0	2	0	2
,, rubbed.............................. ,,	0	2	0	$2\frac{1}{4}$	0	$2\frac{1}{2}$
,, circular .... ,,	0	$3\frac{1}{2}$	0	$4\frac{1}{2}$	0	6
Grooving up to $1\frac{1}{2}$ in. girth.............. ,,	0	$3\frac{1}{4}$	0	$3\frac{1}{4}$	0	$3\frac{1}{4}$
Rounded nosings .... ,,	0	$2\frac{1}{2}$	0	3	0	4
,, ,, circular.............. ,,	0	$3\frac{1}{4}$	0	4	0	5
Rebating on edges up to 3 in. girth ... ,,	0	$1\frac{1}{4}$	0	2	0	$2\frac{1}{4}$
,, ,, circular.............. ,,	0	$2\frac{1}{2}$	0	3	0	$3\frac{1}{2}$
Scribing .... ,,	0	$4\frac{1}{2}$	0	5	0	$5\frac{1}{2}$
Throating .... ,,	0	1	0	$1\frac{1}{2}$	0	$1\frac{1}{2}$
,, circular......................... ,,	0	$1\frac{1}{2}$	0	$1\frac{3}{4}$	0	2
Corners rounded, plain, up to 6 in. girth... each	0	2	0	$2\frac{1}{2}$	0	3
Holes drilled and countersunk up to $1\frac{1}{2}$ in. diameter	0	1	0	$1\frac{1}{2}$	0	2
Ditto, ditto, from $1\frac{1}{2}$ in. to 3 in. diameter ,,	0	$2\frac{1}{2}$	0	$3\frac{1}{2}$	0	$4\frac{1}{2}$
Holes for basin .... ,,	2	0	2	3	2	6
Holes drilled and countersunk or tapped for screws ....per dozen	1	$3\frac{1}{2}$	1	6	1	8
Screws, copper, strong, 2 in., for fixing slate fittings, S.O. ....per dozen	0	10	0	10	0	10
Partitions and slabs taken down and removed ....per ft. sup.	0	1	0	1	0	1

Slate Masonry—*continued.*

		s.	d.
Slate channel course for urinals, &c., 9 in. × 4 in., with semi-circular 3-in. channel, dished to current and set in cement	per ft. run	4	6
Labour only in sinking 3-in. channel, with current ½ in. deep...	,,	0	5
Slate skirting, 6 in. by ¾ in., planed O.S., chamfered and fixed with screws	,,	1	0
Stopped ends to channels, labour only...	each	0	9
,, chamfers, grooves, &c.	,,	0	1
Cutting holes in slate channels 3 in. thick, and rebating for grating	,,	2	0
Mortises or rail holes up to 1½ in. deep	,,	0	4

			£	s.	d.
Slate cisterns, 1 in. thick, delivered and fixed complete,	100 gals.	each	3	10	0
,, 1¼ in. ,, ,, ,,	150 ,,	,,	4	10	0
,, 1½ in. ,, ,, ,,	200 ,,	,,	6	0	0
,, 1½ in. ,, ,, ,,	250 ,,	,,	6	10	0
,, 1½ in. ,, ,, ,,	300 ,,	,,	7	10	0

Materials.

(supplied only.)

		s.	d.
Cement oil	per lb.	0	2
Cement, red lead	,,	0	2¾
Oil putty	,,	0	6
Clips, strong, for slates, copper	,,	1	6
,, ,, ,, lead	,,	0	3½
,, ,, ,, zinc	,,	0	4
Nails, slating, composition	,,	0	7
,, ,, copper cast	,,	1	2
,, ,, ,, wrought	,,	1	6
,, ,, iron, dipped in boiled oil or painted ...	,,	0	5
,, ,, zinc	,,	0	11
Cement, Portland	per bushel	1	10
Lime, ground, stone	,,	0	8¼
Hair mortar	per ft. cube	0	8

			£	s.	d.
Slates, blue Bangor, price at Welsh port,	Singles ...	per 1,200	2	17	6
,, ,, ,, ,,	Doubles	,,	3	0	0
,, ,, ,, ,,	Ladies	,,	4	12	6
,, ,, ,, ,,	Viscountesses	,,	7	10	0
,, ,, ,, ,,	Countesses	,,	9	0	0
,, ,, ,, ,,	Marchionesses	,,	10	17	6
,, ,, ,, ,,	Duchesses	,,	13	0	0
,, ,, ,, ,,	Princesses	,,	14	15	0
,, ,, ,, ,,	Empresses	,,	16	15	0

Westmorland Slates.

Tilberthwaite Green Slate Co., Kendal, Westmorland.

Names.	Size.	Number of squares covered by 1 ton at 3-in. lap.	Price per ton in truck at Coniston.	Price per ton delivered in London.
Dark Green :—	in. long.		£ s. d.	£ s. d.
Best, selected	12 to 30	2·70	6 0 0	6 17 1
Seconds, selected	12 ,, 26	2·07	3 15 0	4 12 1
Best Peggies, selected	9 ,, 12	2·43	4 10 0	5 7 1
Seconds ,, ,,	6 ,, 9	2·07	2 5 0	3 2 1

The railway rate to London is 17*s.* 1*d.* per ton. Five per cent. discount is allowed off the prices quoted at Coniston.

		s. d.
Wages, slater's	per hour	0 11
,, slater's labourer	,,	0 7

ANALYSIS.

Slates.—The great bulk of slates come from North Wales, and may be roughly divided into three classes most in use for ordinary work :—"Bangor" (chiefly from Lord Penrhyn's quarries at Bethesda, and the Dinorwic or Velinheli quarries, which are working at opposite ends of the same slate vein running N.E. and S.W.) ; "Port Madoc" (from the Oakeley Slate Quarries Co. at Festiniog) ; and "Carnarvon" (from Llanberis, Nantile, and other places from eight to twelve miles distant). These slates are generally blue. It will be observed that the titles are taken from the ports at which the slates are collected for sale and exportation.

Green slates come from Whitland Abbey (near Narberth, Pembrokeshire), and Westmorland (The Tilberthwaite Green Slate Co., Kendal), as well as from Cumberland (Buttermere, from the quarries in Honister Pass), and Lancashire (Coniston). Westmorland slates are always sold by the ton, and have different nomenclature and irregular sizes from Welsh slates. When laid, the courses are not uniform in depth, but diminish towards the ridge.

Other slates come from Cornwall, from the Old Delabole quarries, near Camelford. Leicestershire, Rutlandshire, Northamptonshire, &c., also yield slates. Of late years, a

great many have been imported from the United States, chiefly because of the long strike among the Welsh quarrymen, and American slates are becoming more and more popular. Their price in this country is 9*s.* per 1,000 cheaper than the best Welsh qualities.

The very large slates, such as Imperials, Rags, and Queens, are called "Ton or weight slates," being sold by weight; while the other sizes are called "Count or tally slates," being sold by number.

The trade "thousand," or "long tally," equals 1,200 for buying and selling; but, allowing 5 per cent. for breakages, 1,260 are put into the trucks at the quarry. Small numbers are sold by the 100. In London, slating is frequently sub-let by the contractor. The special rates of the railway companies are for not less than 4-ton lots, and they carry by actual, not computed, weights.

Nails.—Composition nails are best for all good work, as they are stiff and tough. They are cast from an alloy of 7 copper to 4 zinc, and have a yellow, brassy appearance. Copper nails are either cast or wrought; but they are soft and dear. Malleable iron nails are frequently used, dipped while hot in boiled linseed oil to preserve them from corrosion. These can also be painted or galvanised. Cast-iron nails are only employed for temporary work. Zinc nails are very soft, and liable to bend, and as their heads come off in driving, they make a good deal of waste.

All these nails are sold by weight, and the price should lessen with the increase of length. Allow 5 per cent. for waste in reckoning the number to the square.

Nails for small slates, such as Doubles, &c., should be about ... ... $1\frac{1}{4}$ in. long.
Nails for medium slates, such as Countesses, &c., should be about ... ... $1\frac{1}{2}$ in. ,,
Nails for large slates, such as Duchesses, &c., should be about ... ... 2 in. ,,

Weight of Slating Nails.

Nails.	Number per pound.		
	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.	2 in.
Composition	164	144	96
Copper	190	145	90
Malleable iron	280	150	120
Zinc	280	220	90

Labour.—The labour in holing slates, any size, is usually estimated at 5*s*. per 1,000; but if a single slate-holing machine is used, a smart boy, at $3\frac{1}{2}d$. per hour, will be able to hole from 300 to 400 slates in an hour, equivalent to 1*s*. per 1,000.

The following statement shows the labour required per square, which will be less for larger surfaces, as the slating will be performed more quickly. The difference in time for the various kinds represents the extra trouble in handling, greater areas being covered with larger slates in a given time, and the labour in holing is the same for all sizes.

A slater and labourer will lay:—

1 square of	Doubles	(with two nails each)		in $3\frac{1}{2}$	hours.
,,	Ladies	,,	,,	,, $2\frac{1}{2}$	,,
,,	Countesses	,,	,,	,, 2	,,
,,	Duchesses	,,	,,	,, $1\frac{1}{2}$	,,

A slater and labourer will prepare and lay:—

1 square of	Doubles	(with two nails each)		in 5	,,
,,	Ladies	,,	,,	,, $4\frac{1}{2}$	,,
,,	Countesses	,,	,,	,, $3\frac{1}{2}$	,,
,,	Duchesses	,,	,,	,, 3	,,

Plastering against underside of slating, per yard super. in $\frac{1}{2}$ hour.

Cost per Square.—Taking Countess slates, 20 in. long by 10 in. wide, the gauge, if centre-nailed, would be—

$$\frac{\text{Length of slate} - \text{lap}}{2} = \frac{20 \text{ in.} - 3 \text{ in.}}{2} = 8\tfrac{1}{2} \text{ in.}$$

In estimating, therefore, the number of slates required per square of 100 ft. super., the width of the gauge in inches, multiplied by the breadth of the slate in inches, gives the margin or exposed surface of a single slate. This divided into the number of superficial inches in a square (100 ft. super. by 144 sq. in. = 14,400 super. inches per square), will give the number of slates to a square—*e.g.*, $8\frac{1}{2}$ in. gauge by 10 in. breadth of slate = 85 sq. in. margin, and

$$\frac{\text{14,400 super. inches per square}}{\text{85 sq. in. margin per slate}} = \text{170 Countess slates per square.}$$

Allowing 5 per cent. for waste, this would give roundly 180 slates to the square.

As there are two nails per slate, the number of nails required per square will be found by doubling the number of slates—*i.e.*, in this case, 340 nails. Also reckoning 5 per cent. waste for nails, the number for estimating would be some 360. Using $1\frac{1}{2}$ in. composition nails, 144 of which go

to the pound, this latter number would give exactly $2\frac{1}{2}$ lb. per square, as they are sold by weight.

The price of first quality Bangor blue Countess slates was recently £9 per M. of 1,200 at the port, and to this add loading expenses (per rail or per vessel, 1*s.* 6*d.* per ton on all slates), rail to London (12*s.* 6*d.* per ton), and delivery on site, bringing the total up to about £10 delivered. Thus—

	£	*s.*	*d.*
Cost of 1,200 at Welsh port	9	0	0
Loading trucks, 1,200 = 2 tons at 1*s.* 6*d.*	0	3	0
Carriage to London, 2 tons at 12*s.* 6*d.*	1	5	0
Unloading trucks	0	3	0
Cartage in London, say 3 miles at 1*s.* per ton per mile ...	0	6	0
Price delivered	10	17	0

Trade terms are $2\frac{1}{2}$ per cent. discount for cash, or acceptance at three months. The analysis of Countess slating per square would then be :—

	£	*s.*	*d.*
180 first quality Countess slates laid to 3-in. lap, at £10 17*s.* per 1,200 delivered	1	12	6
$2\frac{1}{2}$ lb. of $1\frac{1}{2}$ in. composition nails, at 7*d.* per pound	0	1	$5\frac{1}{2}$
Labour, preparing, and laying, $3\frac{1}{2}$ hours slater (11*d.*) and labourer (7*d.*) at 1*s.* 6*d.* per hour	0	5	3
	1	19	$2\frac{1}{2}$
Add 15 per cent. profit	0	5	$9\frac{1}{2}$
Total price per square	2	5	0

Laths, boarding, felting, &c., are taken in Carpenter.

If the foregoing is sub-let to a slate merchant, it can be done for 33*s.* to 36*s.* per square, as the latter buys his slates at the quarries in large quantities, conveys them by sea, and regularly employs slaters.

A costly item in connection with slating is the repairing or replacing of slates broken after the slating is completed by workmen moving on the roof.

Circular Slating is valued in the same way, but the slates are necessarily smaller according to the radius of the curve, and they are graduated in diminishing sizes from eaves to apex. This requires slates of varying sizes, and an extra 5 per cent. for waste in cutting to graduated shapes, as well as additional labour. The whole will amount to one-fourth more in cost, or one-third if the circular slating is quick or small.

Half or spaced slating will cost one-fifth less.

Vertical Slating to walls is similarly calculated as for

roofs, except that the labour in fixing is increased by half as much again.

Torching.—This is the term applied if (when the slating is laid on laths or open battens) the underside is pointed with hair mortar. Of this two-thirds foot cube will be required. It will take a bricklayer two hours and a labourer half-hour to point a square.

	s.	d.
$\frac{2}{3}$ ft. cube hair mortar at 8*d*.	0	$5\frac{1}{4}$
2 hours bricklayer at $10\frac{1}{2}$*d*.	1	9
$\frac{1}{2}$ hour labourer at 7*d*....	0	$3\frac{1}{2}$
	2	$5\frac{3}{4}$
Add 15 per cent. profit	0	$4\frac{1}{4}$
Price per square	2	10

Plain Ridge Tile, 7 in. Wings, Set in Hair Mortar and Pointed with Cement.—To the net cost of the ridge tile add carriage, hair mortar, cement, labour, and profit, as below. The tile is 18 in. long, at 7*d*. each = $4\frac{1}{2}$*d*. per foot run.

	s.	d.
1 ft. ridge tile, 7 in. wings, supplied only	0	$4\frac{1}{2}$
Carriage...	0	$0\frac{1}{2}$
Hair mortar for setting	0	$0\frac{1}{2}$
Cement for pointing	0	$0\frac{1}{2}$
Labour	0	1
	0	7
Add profit	0	1
Price per foot run	0	8

From an actual job on a large building it was found to take 10 cubic feet of cement mortar, 20 lbs. of red paint to colour the pointing, the ridge tiles being red, and 170 hours of slater and his labourer, for 1,000 ft. run of ridging.

Make good Slating to Pipe passing through Roof.—This will occupy one hour of a slater and labourer at 1*s*. 6*d*., and allow for an additional slate or two and nails as well as profit, making, say, 2*s*. in all.

Slate Damp-proof Course has already been analysed under Bricklayer, and need not be repeated.

Slate Masonry.—As slate masonry consists of such special work as fittings to shelving, washing-benches, lavatory tops, urinals, &c., which need regular machinery to execute the sawing, planing, rubbing, sanding, &c., it is always better to let this to proper slate merchants, who make a special estimate for supply, while the builder fixes.

CHAPTER XII.—TILER.

MEMORANDA.

Plain Tiles.

Plain roofing tiles, $10\frac{1}{2}$ in. by $6\frac{1}{2}$ in. by $\frac{1}{2}$ in., weigh $2\frac{1}{4}$ lb. each, or 20 cwt. per 1,000. One square requires, without allowance for waste :—

If laid with	No. of Tiles.	Laths, Feet Run.	Lathing Nails. No.	Lathing Nails. lb.	Pegs or Pins (Two per Tile).	Weight of Cast-iron Pegs in lb.
$2\frac{1}{2}$-in. lap or 4-in. gauge	554	300	255	$\frac{4}{5}$	1108*	28
$3\frac{1}{2}$,, $3\frac{1}{2}$,,	633	340	289	1	1266*	31
$4\frac{1}{2}$,, 3 ,,	739	400	340	$1\frac{1}{5}$	1478*	37

* Or 1 peck of oak tile pins. A peck = a box 8 in. × 8 in. × 8 in.

The gauge is otherwise known as the face or weather, and it is usual to lay with a $3\frac{1}{2}$-in. lap, giving $3\frac{1}{2}$-in. gauge, 1,000 tiles = 1 load. 500 ft. run of plain tile laths, in 5-ft., 4-ft., or 3-ft. lengths, make one bundle, and one bundle of fir laths is frequently reckoned to the square ; 30 bundles = 1 load.

When tiles are bedded or pointed with mortar, 3 hods or 2 cubic feet of mortar are needed.

Pan Tiles.

Pan roofing tiles, $13\frac{1}{2}$ in. by $9\frac{1}{2}$ in. by $\frac{1}{2}$ in., weigh $5\frac{1}{4}$ lb. each, or 47 cwt. per 1,000. One square requires, without allowance for waste :—

150 tiles, if laid to 12-in. gauge.
164 ,, ,, 11 ,,
180 ,, ,, 10 ,,
1 bundle of 12 laths, each 10 ft. long.
$1\frac{1}{4}$ hundred of sixpenny lathing nails.

Broomhall Tiles.

Broomhall roofing tiles, ordinary size, 12½ in. by 9½ in., weigh 4½ lb. each, or 40 cwt. per 1,000. One square requires, without allowance for waste :—

185 tiles, ordinary size, if laid to a 3½-in. lap.
333 ,, small ,, ,, ,, ,,
1 patent peg for every tile.
1 galv. 3-in. nail for every upper tile (half the number of tiles).
Battens, 3 in. by 1 in., or 3 in. by ¾ in.

PRICES.

		s.	d.
Plain Broseley tiling, laid to 3½-in. gauge, including fir laths and galvanised iron pegs	per square	62	0
Ditto, ditto, if oak are used, add	,,	3	6
,, add for laying in hair mortar	,,	3	8
,, ,, in cement	,,	5	6
,, add for torching with hair mortar	,,	6	6
Stripping old plain tiling, including defective laths, cleaning and stacking...	,,	2	0
Relaying old plain tiling, including labour, nails, and tile pins, and 20 new tiles per square... ...	,,	20	0
Plain weather tiling, 4 in. weather on upright wall, bedded and pointed in hair and ash mortar, each tile to be secured with two nails	,,	54	0
Pointing to verge of plain tiling	per ft. run	0	1
Extra on plain tiling for tile and a half to verges ...	,,	0	1½
Cutting to ridge or verge of plain tiling	,,	0	2
Barge or verge in hair and ash mortar	,,	0	2½
,, ,, in cement	,,	0	4
Filleting with hair mortar	,,	0	1¼
,, with Portland cement	,,	0	2
Ridge and hip tiles, and bedding and pointing in hair and ash mortar	,,	0	8
Ditto, ditto in cement	,,	0	10
Add if with roll or flat crest on top	,,	0	2
Ditto if with ornamental cresting	,,	0	6
Valley tiles, and bedded and pointed in hair and ash mortar	,,	0	10
Ditto, ditto in cement	,,	1	0
Double-plain tile creasing in hair and ash mortar ...	,,	0	6
,, ,, in cement	,,	0	8
Mitreing two hips with ridge	each	1	6
Hip hooks, galvanised or painted, and fixed... ...	,,	1	0
T nails, ,, ,, ...	,,	0	3
Pan tiles, laid dry to 10-in. gauge, including laths ...	per square	24	6
,, add if bedded in hair mortar	,,	3	0
,, add if torched with hair mortar	,,	3	6
,, add if pointed outside	,,	4	0
Stripping old pan tiles, including defective laths, cleaning and stacking...	,,	1	6
Relaying old pan tiles, including labour, laths and nails, and 20 new tiles per square	,,	17	0

		s.	d.
Cutting to splays and hips	per ft. run	0	$2\frac{1}{2}$
Half-round ridges and hips and bedding in mortar...	,,	0	9
Hip hooks, galvanised or painted, and fixed... ...	each	0	10
Broomhall tiling, laid to $3\frac{1}{2}$-in. lap, including battens, and nailed with $2\frac{3}{4}$-in. copper nails, ordinary size	per square	35	0
Ridges for ditto and fixed	per ft. run	1	6
Hips for ditto and fixed...	,,	1	3

Materials.

(SUPPLIED ONLY.)

Broseley tiles, cost at Broseley, less trade discount...	per 1,000	40	0
,, ,, ornamental patterns	,,	42	6
,, ,, gable tiles, "tile and half"	,,	80	0
,, ,, eaves tiles, 7 in. by $6\frac{1}{2}$ in.	,,	40	0
,, ,, hip or valley quoined tiles, 18 in. long	,,	290	0
Ferro-metallic ridge tiles, 6-in. wings, 18 in. long, less trade discount	each	0	4
Ditto, 7-in. wings, ditto...	,,	0	$4\frac{1}{2}$
Tile finials, prime cost	,,	10	0
Fir laths for plain tiles, 2 in. by $\frac{3}{4}$ in. ...	per 100 ft. run	1	6
,, ,, $1\frac{1}{4}$ in. by 1 in.	,,	0	9
,, ,, $1\frac{1}{4}$ in. by $\frac{3}{4}$ in.	,,	0	8
,, ,, 1 in. by $\frac{3}{4}$ in.	,,	0	7
Lathing nails, cut clasp, $1\frac{1}{2}$ in.	per lb.	0	$1\frac{1}{4}$
Cast-iron tiling pegs, 2 in. long	per cwt.	9	6
,, ,, galvanised	,,	18	0
Oak pegs or pins	per bushel	1	9
Pan tiles, delivered	per 1,000	70	0
Laths, in bundles of 12 laths, each 10 ft. long ...	per bundle	3	6
Lathing nails	per 100	0	8
Broomhall tiles, ordinary size	per 1,000	35	0
Tile pegs for ditto	,,	11	0
Tile nails, galvanised	,,	5	6
Broomhall ridge tiles	per pair	1	5
,, hip tiles	each	1	2
Cement, Portland	per bushel	1	10
Lime, ground, stone	,,	0	$8\frac{1}{4}$
Hair mortar	per ft. cube	0	8
Wages, tiler's	per hour	0	$10\frac{1}{2}$
,, labourer's	,,	0	7

ANALYSIS.

Tiles.—Tiles, in shape, are of two main classes: those which, like pan tiles, interlock, and those which, like common plain tiles, are nearly flat, and are laid on the same principle as slates. In the former class innumerable forms have been patented, but few of them get into general use, chiefly owing to difficulties of replacing when broken, and the trouble of fitting them to irregularly-shaped roofs. Plain or crown

tiles are such as have a rectangular form and plane surface. A statute is supposed to regulate their size, but they are generally $10\frac{1}{2}$ in. long, $6\frac{1}{2}$ in. broad, and $\frac{1}{2}$ in. thick, with two holes in them, through which oak pins are inserted to hang upon the laths. Sometimes cast-iron pegs are used instead, or frequently extra large flat-headed wrought nails, made of pure zinc or zinc and copper, which have the advantage of allowing a tile to be replaced from the inside of the roof by lifting up the others to place in the tile and drop in the nails in a few seconds. Sometimes, also, tiles have projecting nibs cast on in lieu of pegs, or they may be both holed and nibbed, so that if the nib is broken off the tile may be nailed. In use, one tile laps over another, and that part which then appears uncovered is called the gauge of the tiling—likewise known as the face or weather. Many tilers have a practice, when plain tiles are set in mortar, not to peg more than one hole in ten; or sometimes only every third or tenth course is nailed. This is bad, as with the decay of the mortar the tile will slip down. For walls, battens nailed or plugged to walls are the best mode of fixing for vertical tile-hanging, the top of each tile being bedded in cement mortar, and the bottom double course bedded and pointed in cement on a tilting fillet.

The roofing tiles employed in London come from Broseley, Reading, Bracknell, Maidenhead, Ruabon, or Staffordshire, and the price per square, unlike the slater's, usually includes the lathing. But the system of measurement is the same.

Laths and Pegs.—Laths or battens are of different sizes; but for good work they should never be less than $\frac{3}{4}$ in. thick. Oak laths are occasionally employed, but fir ones are generally used nailed to each rafter. The latter are imported ready sawn in various dimensions, but may be bought at the sawmills out of converted common stuff, usually in 10 ft. lengths, at the following rates:—

Laths	2 in.	×	$\frac{3}{4}$ in.	cost	1*s.* 6*d.*	per 100 ft.	run.
,,	$1\frac{1}{4}$,,	×	1 ,,	,,	0*s.* 9*d.*	,,	,,
,,	$1\frac{1}{4}$,,	×	$\frac{3}{4}$,,	,,	0*s.* 8*d.*	,,	,,
,,	1 ,,	×	$\frac{3}{4}$,,	,,	0*s.* 7*d.*	,,	,,

The gauge of the laths is the same as that of the tiles, and the number of laths and nails required per square is shown in the table of Memoranda.

Oak pegs cost 1*s.* 9*d.* per bushel, and a square wants a peck, or one-fourth of a bushel. Cast-iron pegs are the best, and should be about 2 in. long. One thousand weighs

25 lb., and costs at the rate of 9*s*. 6*d*. per cwt., or 18*s*. if galvanised. These may be readily valued by allowing two for each tile.

Allow 5 per cent. waste on laths and pegs.

Labour.—The time below indicates the labour required :—

		Hours.	
Fixing laths	per square,	3	carpenter.
Pantiling, laid dry	,,	3	tiler and labourer.
,, pointed inside	,,	4	,, ,,
,, ,, outside	,,	5	,, ,,
,, ,, both sides ...	,,	6	,, ,,
Plain tiling laid to 4 in. gauge ...	,,	6½	,, ,,
,, ,, 3½ ,, ...	,,	7	,, ,,
,, ,, 3 ,, ...	,,	7½	,, ,,

Cost per Square.—Taking plain Broseley tiles, 10½ in. by 6½ in., laid with the usual lap of 3½ in., which also gives a 3½ in. gauge or face, the number needed per square would be 633 (found by the same rule as slates), and allowing 2½ per cent. for waste, the quantity for estimating would be 650.

Of lathing, 340 ft. run will be wanted, assuming rafters 12 in. apart, and reckoning 5 per cent. waste, the total length fixed would be about 360 ft.

The calculated number of nails is 289, plus 5 per cent. waste, equals 304, or 1$\frac{1}{16}$ lb. of 1½ in. cut clasp nails for laths.

If cast-iron pegs are specified, the number required will be twice the quantity of tiles ; in this case 1,266, or, say, 1,300, allowing for waste. And as 1,000 pegs weigh 25 lb., the weight would be 33 lb. to the square.

		s.	*d.*
Broseley tiles in trucks (less 5 per cent. trade discount)	per 1,000	40	0
Railway rate to Paddington, in 5 ton lots	,,	7	6
Loading and unloading carts, 2 hours labourer at 6½*d*.	,,	1	1
Cartage from Paddington to site, say 3 miles at 1*s*. ...	,,	3	0
Price delivered		51	7

	£	*s.*	*d.*
650 plain Broseley tiles, at 51*s*. 7*d*. per 1,000, delivered ...	1	13	7
360 ft. run, 1¼ in. by ¾ in. laths, at 8*d*. per 100 ft. run ...	0	2	4¾
304 or 1$\frac{1}{16}$ lb. 1½-in. cut clasp nails, at 1¼*d*. per lb.	0	0	1¼
Fixing laths, 3 hours carpenter at 10½*d*.	0	2	7½
1,300 or 33 lb. cast-iron pegs, galvanised, at 18*s*. per cwt. ...	0	5	3½
Fixing tiles, 7 hours tiler (10½*d*.), and labourer (7*d*.) at 1*s*. 5½*d*.	0	10	2½
	2	14	2½
Add 15 per cent. profit	0	7	9½
Total price per square	3	2	0

Add for Laying in Hair Mortar.—Two cubic feet of hair mortar will be required for bedding, and the labour will be $1\frac{1}{2}$ hour tiler, and 1 hour labourer.

	s.	d.
2 cubic feet hair mortar at 8*d*.	1	4
$1\frac{1}{2}$ hour tiler at $10\frac{1}{2}d$.	1	$3\frac{3}{4}$
1 hour labourer at 7*d*....	0	7
	3	$2\frac{3}{4}$
Add profit	0	$5\frac{1}{4}$
Price per square	3	8

Pantiling Laid Dry.—When pantiles are laid to the customary gauge of 10 in., a square will be covered by 180. One bundle of laths and $1\frac{1}{4}$ hundred of nails will also be required. Each tile is invariably hung on to the laths or battens by a nib which projects from the upper edge at the back.

	£	s.	d.
180 pantiles at 70*s*. per 1,000 delivered...	0	12	$7\frac{1}{2}$
1 bundle of 12 laths, each 10 ft. long	0	3	6
$1\frac{1}{4}$ hundred lathing nails, at 8*d*. per hundred...	0	0	10
Labour fixing, 3 hours tiler and labourer at 1*s*. $5\frac{1}{2}d$.... ...	0	4	$4\frac{1}{2}$
	1	1	4
Add 15 per cent. profit	0	3	2
Total price per square	1	4	6

Ridges, Valleys, Verges, &c., are calculated in the same manner as shown in Slater's Work.

CHAPTER XIII.—CARPENTER, JOINER, AND IRONMONGER.

MEMORANDA.

40 cubic feet of unhewn timber			... ...	1 Load.
50 ,,	squared ,,		... ...	
600 super. feet of 1 in. planks, or deals			... ...	
400 ,,	$1\frac{1}{2}$	,, ,,	... ...	
300 ,,	2	,, ,,	... ...	
240 ,,	$2\frac{1}{2}$	,, ,,	... ...	
200 ,,	3	,, ,,	... ...	
170 ,,	$3\frac{1}{2}$	,, ,,	... ...	
150 ,,	4	,, ,,	... ...	

1 Float = 18 Loads.
1 Stack = 108 cubic feet (12 ft. by 3 ft. by 3 ft.)
1 Cord = 128 ,, (8 ft. by 4 ft. by 4 ft.)
1 Fathom = 216 ,, (6 ft. by 6 ft. by 6 ft.)
1 Square = 100 super. feet (10 ft. by 10 ft.)

Deal Standards.

	No.	ft.	in.	in.	ft. sup.	ft. cu.
St. Petersburg	120 ×	12 by	11	by $1\frac{1}{2}$ =	1,320 =	165
London and Irish	120 ×	12 by	9	by 3 =	1,080 =	270
Christiania hundred	120 ×	11 by	9	by $1\frac{1}{4}$ =	990 =	$103\frac{1}{8}$
,, ,, ...	60 ×	15 by	11	by $1\frac{1}{2}$ =	825 =	$103\frac{1}{8}$
Drammen hundred	120 ×	9 by	$6\frac{1}{2}$	by $2\frac{1}{2}$ =	585 =	$121\frac{7}{8}$
Quebec long hundred	120 ×	10 by	11	by 3 =	1,100 =	275
,, short ,, ...	100 ×	12 by	11	by $2\frac{1}{2}$ =	1,100 =	$229\frac{1}{6}$

One hundred deals 120.

					ft. sup.
St. Petersburg Standard, if reduced to			3 in. thick	=	660
,,	,,	,,	$2\frac{3}{4}$	,, =	720
,,	,,	,,	$2\frac{1}{2}$	,, =	792
,,	,,	,,	$2\frac{1}{4}$	,, =	880
,,	,,	,,	2	,, =	990
,,	,,	,,	$1\frac{3}{4}$	,, =	1,131
,,	,,	,,	$1\frac{1}{2}$	,, =	1,320
,,	,,	,,	$1\frac{1}{4}$	,, =	1,584
,,	,,	,,	1	,, =	1,980
,,	,,	,,	$\frac{3}{4}$	,, =	2,640

Market Forms of Timber.

A *log* is a trunk of a tree with the branches lopped off.

A *balk* is obtained by roughly squaring the log.

Hand masts are the longest, soundest, and straightest trees after being topped and barked. The term is technically

applied to those of a circumference between 24 in. and 72 in. They are measured by the hand of 4 in., there being also a fixed proportion between the number of hands in the length of the mast and those contained in the circumference taken at one-third the length from the butt end.

Spars or *poles* have a circumference of less than 24 in. at the base.

Inch masts are those having a circumference of more than 72 in., and are generally dressed to a square or octagonal form.

Balk timber, or *square timber*, consists of the trunk hewn square, generally with the axe, but sometimes with the saw.

Deal is the general term given to fir timber when sawn into convenient dimensions for purposes where large scantlings are not required—as in joiner's work. In this form it comes into the market, sawn into different widths, known as "planks," "deals," and "battens," varying from 1 in. to 4 in. thick, but principally 3 in., and in length from 8 ft. to 20 ft., but chiefly 12 ft. There is, however, no strict classification, and of late years all sorts of intermediate sizes have been imported.

Planks are from 10 in. to 12 in. wide, but chiefly 11 in.

Deals are from 8 in. to 9 in. wide, but chiefly 9 in.

Battens are from 4 in. to 7 in. wide, but chiefly 7 in.

Ends are pieces of plank, deal, or batten, less than 8 ft. long.

Scaffold and *ladder poles* are from young trees of larch or spruce. They average about 33 ft. in length, and are classed according to the diameter of their butts.

Rickers are about 22 ft. long, and under 2½ in. diameter at the top end.

Timber: How Sold.

Fir, American pine, greenheart, oak, ash, elm, teak, and pitch-pine are sold by the load of 50 ft. cube—sometimes caliper, and sometimes string measure.

Wainscot in London at per 18 ft. cube logs; but at per cubic foot at most other ports.

Cedar and mahogany at per foot super., of inch thick.

Planks, deals, and battens are usually sold in London by the six-score, or "long hundred" (120 pieces), reduced to the St. Petersburg standard.

Flooring, and matched and grooved boarding, by the reputed or customary square.

Beads, mouldings, skirtings, and weather-boards by the 100 ft. run.

Battens for slates or tiles by the 144 ft. run.

Plasterers' laths at per bundle of 360 ft. to 500 ft. run.

Lathwood at per cubic fathom of 6 ft. × 6 ft. × 6 ft. = 216 ft. cube.

Weights of Timbers.

Pine Wood.

Name.	Weight per f.c.	F.C. per ton.
Fir, Norway spruce...	30 lb.	75
Larch ...	35 ,,	64
Pine, Northern, Memel	36 ,,	62
,, ,, Riga	34 ,,	66
,, pitch	41 ,,	55
,, red, American	36 ,,	62
,, white	28 ,,	80
,, yellow	26 ,,	86
,, Kauri, New Zealand	38 ,,	59

Hard Wood.

Name.	Weight per f.c.	F.C. per ton.
Ash	50 lb.	45
Beech ...	51 ,,	44
Blue gum	53 ,,	42
Chestnut	38 ,,	59
Ebony...	70 ,,	32
Elm	40 ,,	56
Greenheart	60 ,,	37
Hornbeam	53 ,,	42
Jarrah ...	51 ,,	44
Lignum vitæ ...	80 ,,	28
Mahogany, Honduras	42 ,,	53
,, Spanish ...	53 ,,	42
Oak, American white	53 ,,	42
,, Dantzic ...	48 ,,	47
,, English ...	50 ,,	45
Sycamore	37 ,,	61
Teak	46 ,,	49
Walnut, black	60 ,,	37

Waste in Converting Timber into Scantlings.

White pine logs	20 per cent.	Greenheart...	30 per cent.
Northern pine	23 ,,	Spanish mahogany	30 ,,
Pitch pine ...	25 ,,	Honduras ditto	31 ,,
Teak	29 ,,	English elm	34 ,,
American white oak	30 ,,	English oak	35 ,,

5 cubic feet per load, or $\frac{1}{10}$th, are usually allowed for waste in sawing fir and pine into planks.

An allowance of one-third to half is usually made for

waste on scaffolding, gantries, centring, &c., on reconverting to use.

In practice it is usually considered that an ordinary "Northern pine" deal, 9 in. wide, will shrink in seasoning $\frac{1}{4}$ in., and a "white deal" $\frac{1}{8}$ in.

Hoop Iron.

410 ft. run hoop iron $1\frac{1}{4}$ in. wide, No. 16 Birmingham wire gauge = 1 cwt.

576 ft. run hoop iron $1\frac{1}{4}$ in. × $\frac{1}{16}$ in., No. 16 Birmingham wire gauge = 1 cwt.

360 ft. run hoop iron $1\frac{1}{2}$ in. × $\frac{1}{16}$ in., No. 16 Birmingham wire gauge = 1 cwt.

A bundle of hoop iron $1\frac{1}{2}$ in. × $\frac{1}{16}$ in. contains 180 ft., and weighs $\frac{1}{2}$ cwt.

A knot of sash-line = 12 yards.

1,000 shingles, with 4 in. weather, will cover 100 ft. super., and will require 5 lb. of nails.

There are 3,000,000 acres of woodland in the British Islands.

To measure round tapering timber—

$$\frac{(\frac{1}{4}\text{ middle girth in inches})^2 \times \text{ft. run in log}}{113} = \text{cubic feet in log.}$$

PRICES.

Timber in Scantling.—(Supplied Only.)

		s.	d.
Ash	per ft. cube	4	6
Elm, English	,,	3	0
Oak, English	,,	6	0
Yellow pine	,,	3	0
Pitch-pine	,,	2	4
Teak, Moulmein	,,	9	0
Dantzic fir, in balk, delivered on site	,,	2	10
,, in deals ,, ...	,,	1	7
,, mixed ,, ...	,,	2	0

Timber Fixed, but not Framed.

Fir, under 144 sq. in. in section, rough	per ft. cube	2	10
,, ,, ,, wrought... ...	,,	3	3
Fixing only foregoing...	,,	0	6
Oak in sleeper plates, rough	,,	6	9
,, in curbs, rough	,,	7	0
,, ,, planed and rebated	,,	7	6
Creosoting fir in vacuum, at 10 lb. to the cubic foot (at a pressure of at least 100 lb. per square inch), including carriage	,,	0	8

Timber Framed and Fixed.

Fir, under 144 sq. in. in section, rough	per ft. cube	4	3
,, ,, ,, wrought ...	,,	5	0
Framing and fixing only foregoing...	,,	0	11

Timber Framed and Fixed—*continued.*

		s.	d.
Proper fir door-frames, wrought, framed, rebated, chamfered or beaded, and fixed	per ft. cube	5	4
Ditto, in double rebated transoms, ditto	,,	6	0
Pitch-pine, under 144 sq. in. in section, rough ...	,,	3	9
,, ,, ,, wrought	,,	4	7
Oak, under 64 sq. in. in section, rough	,,	7	9
,, ,, ,, wrought ...	,,	8	9
Add to all timber when put together with white-lead	,,	0	2
Hoisting trusses for every 10 ft. above 30 ft. ...	,,	0	9

Pile Driving.

		s.	d.
Fir piles, including planting in position	per ft. cube	2	3
,, in sheet or small piles, 9 in. square, and ditto	,,	2	5
Driving whole piles (portion in ground only to be measured)	,,	1	0
Driving sheet or small piles, 9 in. square, and ditto	,,	1	3
Heading and pointing where rings and shoes are not required, including cutting off heads after driving	each	2	6
Ditto, where rings and shoes are required, including nails and fitting and fixing shoes or rings ...	,,	5	0
Allowance for bringing, erecting, and removing pile-engine and tackle, &c., for driving	per job	10	0

Architraves.

		s.	d.
5-in. by 2-in. moulded architrave, and fixed ...	per foot run	0	6
4½-in. by 1¼-in. ,, ,, ,, ...	,,	0	4
3-in. by 1-in. wrought and chamfered architrave, and fixed	,,	0	2½
Mitres, per inch girth of architrave	,,	0	0½
2 in. wrought and chamfered blocks or plinths up to 9 in. high	each	0	9

Battens and Fillets.

		s.	d.
Deal battening, 2 in. by ⅝ in., spaced for Countess slating, and fixed with iron nails...	per square	5	4
Ditto, for walls, fixed with elm plugs	,,	6	0
Raking cut on battens as to hips or valleys ...	per foot run	0	0½
Plugging, driven into brickwork 18 in. apart ...	,,	0	1

Description.		½ in.		¾ in.		1 in.		1¼ in.		1½ in.		2 in.	
	per ft. run	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Deal fillets, rough, 1 in. wide, s. o...	,,	0	0$\frac{1}{16}$	0	0⅛	0	0⅛	0	0⅛	0	0¼	0	0¼
Do. 2 in. ,, ,, ...	,,	0	0⅛	0	0⅛	0	0¼	0	0¼	0	0⅜	0	0½
Do. 3 in. ,, ,, ...	,,	0	0¼	0	0¼	0	0⅜	0	0⅜	0	0½	0	0¾
Do. wrought, 1 in. do. do.	,,	0	0⅛	0	0¼	0	0¼	0	0¼	0	0½	0	0½
Do. do. 2 in. do. do.	,,	0	0⅜	0	0⅜	0	0½	0	0½	0	0¾	0	1
Do. do. 3 in. do. do.	,,	0	0½	0	0½	0	0¾	0	0¾	0	1	0	1¼

BATTENS AND FILLETS—*continued.*

Description.		½ in.		¾ in.		1 in.		1¼ in.		1½ in.		2 in.	
	per ft. run	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Add for each angle if beaded, chamfered, or rounded	,,	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼	0	0¼
Add if framed ...	,,	0	0½	0	0¾	0	1	0	1	0	1	0	1¼
Add nails, labour, and profit.........	,,	0	0½	0	0½	0	0½	0	0½	0	0½	0	0¾

		s.	*d.*
4-in. by 1-in. rough feather-edge tilting fillet, and fixed	per ft. run	0	2

Add to fillets, if bent circular, one-fourth foregoing rates.
For oak fillets, ,, double ,, ,,
For mahogany or teak fillets, treble ,, ,,

BRACKETING.

1-in. deal bracketing to cornices	per ft. sup.	0	5
1¼-in. ,, ,, ...	,,	0	6
Angle brackets	each	0	8
Bracketing to soffits of eaves, or round girders, &c.	,,	0	4

MACHINE-PREPARED BOARDINGS.

Of Deal in Batten Widths.		¾ in.		1 in.		1¼ in.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*
Rough, supplied only, at docks,	per square	11	0	13	0	15	0
,, ,, on site	,,	13	0	15	4	17	6
Ditto, nails, labour, and profit only, in fixing	,,	6	0	6	2	6	6
Ditto, and fixed complete in roofs	,,	17	0	21	6	25	6
Ditto, traversed for lead or zinc, and firring to falls...............	,,	26	0	28	6	31	0
Add if edges shot	,,	1	0	1	0	1	6
,, wrought one side	,,	1	6	1	6	1	6
,, ,, both sides	,,	2	6	2	6	2	6
,, ploughed and tongued, or rebated	,,	2	2	2	7	3	2
,, on curved surfaces	,,	2	1	2	8	3	4
,, in ceilings and fixed from beneath	,,	1	3	1	3	1	10
Add for raking cut and waste to hips and valleys	per ft. run	0	1	0	1¼	0	1½

Machine-prepared Matchboardings.

		$\frac{5}{8}$ in.		$\frac{3}{4}$ in.	
		s.	d.	s.	d.
Yellow deal matchboarding, firsts, supplied only, at docks	per square	12	0	14	6
Ditto, ditto, on site	,,	14	0	16	9
Ditto, nails, labour, and profit, only, in fixing	,,	5	6	5	9
Ditto, and fixed complete	,,	19	6	22	6

Deal Boarding.

Description.		$\frac{1}{2}$ in.		$\frac{3}{4}$ in.		1 in.		$1\frac{1}{4}$ in.		$1\frac{1}{2}$ in.		2 in.	
	per ft. sup.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Rough, supplied only on site, including profit	,,	0	$1\frac{1}{2}$	0	2	0	$2\frac{1}{2}$	0	3	0	4	0	5
Add if edges shot ...	,,	0	$0\frac{1}{2}$	0	$0\frac{1}{2}$	0	$0\frac{1}{2}$	0	$0\frac{3}{4}$	0	1	0	$1\frac{1}{4}$
,, wrought one side	,,	0	$0\frac{1}{2}$	0	$0\frac{1}{2}$	0	$0\frac{3}{4}$	0	$0\frac{3}{4}$	0	1	0	1
,, ,, both sides	,,	0	1	0	1	0	$1\frac{1}{2}$	0	$1\frac{1}{2}$	0	2	0	2
,, if ploughed and tongued... ...	,,	0	$0\frac{1}{2}$	0	$0\frac{1}{2}$	0	$0\frac{3}{4}$	0	1	0	$1\frac{1}{4}$	0	$1\frac{1}{4}$
,, framed	,,	0	3	0	3	0	$3\frac{1}{4}$	0	$3\frac{1}{4}$	0	$3\frac{1}{2}$	0	$3\frac{1}{2}$
,, fixed and cut ...	,,	0	$1\frac{1}{4}$	0	$1\frac{1}{2}$	0	$1\frac{1}{2}$	0	2	0	2	0	$2\frac{1}{2}$
,, hung (exclusive of hinges and screws)	,,	0	1	0	1	0	1	0	$1\frac{1}{4}$	0	$1\frac{1}{2}$	0	$1\frac{3}{4}$

		s.	d.
1-in. gutter boards and bearers	per ft. super.	0	7
Rebated drips	per ft. run	0	2
7-in. by $1\frac{1}{2}$-in. rough deal ridge board and fixed ...	,,	0	3
$1\frac{1}{4}$-in. deal dovetailed cesspool, 9 in. by 9 in. by 6 in., holed and fitted	each	2	6

Curved work, bent in fixing, is $1\frac{1}{4}$ price of straight.
Curved face, as to cylinders, &c., is $1\frac{1}{2}$ price of straight.
Curved on plan, as to ribs, &c., is 2 price of straight.
Curved work, glued up in thicknesses, is 3 price of straight.
Double the foregoing prices for oak.
Treble the foregoing deal prices for mahogany or teak.

Centrings and Casings.

Prices are for first use, including supports, casing, and striking. For every subsequent use take one-third of the prices below :—

		s.	d.
Use of straight centring to vaults, arches, &c. ...	per square	27	0
,, 1-in. flat centring to concrete floors... ...	,,	16	3
Extra for intersections of groins	per ft. run	0	6
Centring, with laggings, for ordinary openings ...	,,	0	6
Turning pieces for $4\frac{1}{2}$-in. soffit	,,	0	3
,, ,, 9-in. ,, ...	,,	0	5

CENTRINGS AND CASINGS—*continued.*

		s.	d.
Use and waste of casings for concrete walls, and removal	per yd. sup.	1	9
Use and waste of casings curved on plan, and removal	,,	2	3
Add if in narrow widths for jambs, &c.	,,	0	6
Yellow pine pattern for cast-iron hollow column, 5 in. mean external diameter, of ¾-in. metal, 8 ft. 8 in. high to top of cap, with square cap and base plates, moulded cap, necking, base, and with square boxing 14 in. high on top of cap	each	30	0

DOORS AND GATES.

Including labour in hanging, and fixing only the hinges.

Description.	1¼ in.	1½ in.	2 in.
	s. d.	s. d.	s. d.
Deal door, 4-panel, framed square and flat per ft. sup.	0 11	1 0	1 1
,, ,, flush square and flat ,,	0 9½	0 11½	1 1
,, 6-panel, framed square and flat ,,	—	1 0	1 1
,, ,, flush square and flat ,,	—	1 1	1 2
Add for double margins separated by a bead, or hung in two leaves ....per ft. sup.	0 1	0 1¼	0 1½
Add to square and flat framing, if stop-chamfered, for each side ....per ft. sup.	0 1	0 1	0 1¼
Add to square framing, if moulded, 4-panel doors, for each side ....per ft. sup.	0 1	0 1	0 1¼
Ditto, 6-panel doors, ditto .... ,,	0 1¼	0 1¼	0 1¼
Sash door, with lower panels framed square and flat, and the upper portion framed as a sash with diminished stiles, and moulded and rebated for glass......per ft. sup.	—	1 1	1 2
Ledged doors, wrot., ploughed andtongued or rebated, boards beaded or V-chamfered per ft. sup.	0 9	0 10½	1 0½
Add if braced .... ,,	0 1½	0 1¾	0 2
Add if hung in two leaves, folding... ,,	0 1	0 1¼	0 1½
Framed and braced doors and gates, wrot., ploughed, tongued and beaded, or rebated and beaded, or V-chamfered ½-in. or ¾-in. battens ....per ft. sup.	—	1 1	1 3½
Add if prepared with a wicket, including hanging the wicket ....per wicket	—	6 0	7 0
Add to all doors if put together with white lead ....per ft. sup.	0 0½	0 0½	0 0½

Add 20 per cent. if doors of clean pitch-pine instead of deal.

For oak doors double the prices for deal ones.

Floors.

Laid complete, with straight joists and splayed headings. Floors to have two nails in each board to every joist, punched and puttied :—

Description.	1¼ in.		1½ in.		2 in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Yellow deal wrought batten floor, edges shot and fillistered ....per square	26	1	29	7	38	0
Ditto, ploughed and tongued, or rebated and filleted ....per square	30	6	33	8	42	6
Ditto, and tongued with hoop iron, 1¼ in. by $\frac{1}{16}$ in., painted in red lead, two coats ....per square	34	6	38	0	46	6
Yellow deal floor in 4½-in. widths (as sketches Figs. 32 and 33), wrought, rebated, and filleted. The fillets to be 1 in. by ¼ in., and the fillets and edges of boards to be coated with white lead, and each board to be cramped up singly till the white lead squeezes out at top. The concrete bed to be spread over with a mixture of pitch and tar ⅜ in. thick, in the proportion of 1 cwt. of pitch to 7½ gal. of coal-tar, boiled together for at least one hour so that when cold it may be elastic and tough (price exclusive of concrete and wood joists) ....per square	66	0	—		—	
Pitch-pine floor as per sketch Fig. 34, the boards to be in 4½-in. widths, wrought, rebated, and filleted, the fillets being 1 in. by ⅜ in. The fillets and edges of the boards to be coated with white lead, and each board to be cramped up singly till the white lead squeezes out at the top ....per square	—		55	0	—	
Add to deal flooring if copper nails be used instead of iron ones ....per square	5	0	7	0	9	0
Glued and mitred border to yellow deal floor ....per ft. run	0	3	0	3½	0	4
Extra to forming sinking for mat, 3 ft. by 2 ft... each	5	0	6	0	8	0

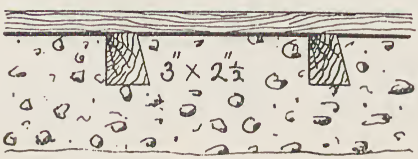

Fig. 32.

FIG. 33.

FIG. 34.

OAK FLOORS.

Description.	$1\frac{1}{4}$ in.		$1\frac{1}{2}$ in.		2 in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*
Wrought, edges shot, and fillistered, per square	78	3	96	10	111	10
Ditto, ploughed and tongued, or rebated and filleted, with oak tongues or fillets per square	87	10	106	9	122	8
Ditto, with hoop-iron tongues or fillets, painted two coats with red lead...per square	88	10	107	9	122	8
Add to all flooring if oak trenails be used instead of iron nails ....per square	11	8	12	6	12	10
Ditto, if copper nails be used instead of iron ones in oak floors ....per square	8	0	10	0	14	0

WOOD BLOCK FLOORING (GEARY'S).

Laid complete (exclusive of concrete base). Prices are for quantities not less than 200 yards super.

		$1\frac{1}{2}$ in.		2 in.	
		s.	*d.*	*s.*	*d.*
Red or yellow deal	per yd. sup.	5	3	6	3
Pitch-pine	,,	5	7	7	0
Oak	,,	9	9	12	6
Walnut or teak...	,,	15	0	18	0
Acme wood block flooring, 12 in. by $2\frac{3}{4}$ in. by $1\frac{1}{2}$ in., of pitch-pine, laid on bituminous composition	,,	6	4	9	0

Parquet Floors.

Laid complete (exclusive of base). Prices are for quantities not less than 500 ft. super., and including wax-polishing, ordinary patterns.

		¼ in. s.	d.	1 in. solid. s.	d.
Oak filling	per ft. sup.	1	4	1	9
„ border	„	1	10	2	3

		s.	d.
Borders of oak round hearths, 3 in. to 4 in. wide and ¾ in. to 1 in. thick, wrought and mitred, including sinking floor for same	per ft. run	0	8
Dowels of oak, as for floors, 2 in. long by ½ in. diam., including holes	each	0	0¾

Sound Boarding and Strutting.

		s.	d.
¾-in. sound boarding, including 1¼-in. by 1-in. deal fillets	per square	24	2
Ditto, ditto, with edges shot	„	26	0
Sawdust filled in 4 in. thick	per yd. sup.	1	0
2-in. by 1½-in. herring-bone strutting to 11-in. joists, and nailed	per ft. run	0	4½
Pugging to floors, with coarse stuff and chopped bay, 3 in. thick, the net quantity between joists being measured	per yd. sup.	0	9

Rolls.

		s.	d.
2-in. deal roll for lead, and fixed	per ft. run	0	2½
„ „ birdsmouthed, and ditto ...	„	0	2¾
Mitres to ditto, one intersection	each	0	2½
„ „ two hips with ridge	„	0	5
Splayed ends to rolls	„	0	1

Partitions.

Description.	1 in. s.	d.	1¼ in. s.	d.	1½ in. s.	d.
Deal, framed square and flat panel...per ft. sup.	0	7½	0	8	0	9½
Deduct if left rough on one side ...... „	0	1	0	1	0	1½
Add if moulded on one side .... „	0	1	0	1	0	1½
Add for any portion framed as a sash „	0	1	0	1¼	0	1¾

Framed work circular on plan, flat sweep, 1½ time above prices.

Framed work, circular on plan, quick sweep, 2 times above prices.

Casements, Sashes, and Sash Frames.

With straight heads, circular sashes being measured as square.

		$1\frac{1}{2}$ in.	2 in.
		s. d.	*s. d.*
Bevelled or moulded bar sashes, fixed	... per ft. sup.	0 $6\frac{1}{2}$	0 $7\frac{1}{2}$
Add if hung with, and including, best flax line and round iron weights (pulleys taken with frames)	,,	0 $2\frac{1}{4}$	0 $2\frac{1}{2}$
Add to sashes if hung with hinges or pivots, exclusive of value of the hinges or pivots...	,,	0 1	0 1
Add for ogee or moulded ends to stiles	... each sash	0 4	0 4
		For $1\frac{1}{2}$-in. sashes.	For 2-in. sashes.
		s. d.	*s. d.*
Deal-cased frames prepared for sashes, with oak sunk and weathered sills grooved for iron tongue and for window-board if required, 1-in. deal outside and inside linings, 2-in. heads, $1\frac{1}{4}$-in. pulley stiles, tongued to inside and outside linings, $\frac{3}{8}$-in. parting beads, $\frac{1}{2}$-in. back linings and parting slips; the inside beads $1\frac{1}{4}$ in. wide and $\frac{3}{4}$ in. thick; double hung, and including and fixing brass axle pulleys; and plugging to wall	... per ft. sup.	0 11	1 $1\frac{1}{2}$
		Fir.	Oak.
		s. d.	*s. d.*
Solid frames, common or transom (prepared for $1\frac{1}{2}$-in. or 2-in. sliding sashes or sashes hung on pivots), $4\frac{1}{2}$ in. by $3\frac{1}{2}$ in., rebated on the solid if required, with oak weathered and rebated sills grooved for tongue or window-board if required, deal parting beads, slips, and oak weather beads, $\frac{3}{4}$-in. outside linings and inside beads, sill grooved for weather bead, and plugged to wall... ...	,,	0 10	1 4
Sash sills and tongues (both included) bedded in white lead	... per ft. run	0 2	0 2

Shutters.

Prepared to be hung with hinges, or lines and weights, or to slide, including labour of hanging, but exclusive of hinges and screws and fixing them.

Description.	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
	s. d.	*s. d.*	*s. d.*
Two-panel, framed square and flat...per ft. sup.	0 $8\frac{1}{2}$	0 $9\frac{3}{4}$	0 11
,, ,, moulded on one side ,,	0 10	0 11	1 0
,, ,, ,, on two sides ,,	0 11	1 $0\frac{1}{4}$	1 1
Three-panel, framed square and flat ,,	—	0 10	0 11
,, ,, moulded on one side ,,	—	0 $11\frac{1}{2}$	1 $0\frac{1}{2}$
,, ,, ,, on two sides ,,	—	1 1	1 $1\frac{1}{2}$
Add if hung in two or more heights or widths per ft. sup.	0 $1\frac{3}{4}$	0 $1\frac{3}{4}$	0 $1\frac{3}{4}$
Add if hung with and including best flax lines and round cast-iron weights...per ft. sup.	0 $2\frac{3}{4}$	0 $2\frac{3}{4}$	0 $2\frac{3}{4}$

Jambs, Soffits, &c.

Description.	1 in.		1¼ in.		1½ in.	
	s.	d.	s.	d.	s.	d.
Jambs and soffits of deal, plain, wrought, and fixed complete, including beading, scribing, &c. ....per ft. sup.	0	5½	0	6¼	0	7
Ditto, single rebated, ditto............... ,,	0	6	0	6¾	0	7½
Ditto, double rebated, ditto .... ,,	0	6½	0	7¼	0	8
Ditto, framed square and flat in one or two panels, ditto ....per ft. sup.	0	8¾	0	9¾	0	10¾
Ditto, in three or four panels, and ditto ,,	0	9¾	0	10¾	1	0
Add if rebated one edge.................. ,,	0	0½	0	0½	0	0½
,, two edges .... ,,	0	1	0	1	0	1
Add if moulded or bead and flush ... ,,	0	1	0	1	0	1¼
Add if jambs or soffits are fixed on splay ,,	0	0½	0	0½	0	0¾
Backs, elbows, or soffits, as for windows and back linings, and fixed complete, glued and keyed ....per ft. sup.	0	8	0	9	0	11
Ditto, ditto, framed square panels ,,	0	6½	0	7	0	9
Ditto, ditto, bead and flush......... ,,	0	7½	0	8	0	10
Add if moulded .... ,,	0	1¼	0	1¼	0	1¼
Window boards, wrot. o. s., with rounded edge and bearers .... per ft. sup.	0	7	0	9	—	
Ends of ditto fitted to jambs and returned, each	0	4	0	4½	—	

Staircases.

		s.	d.
1¼-in. treads with rounded nosings and small moulding beneath, and 1-in. risers, grooved and rebated together, glued, blocked, and bracketed on, and including strong fir carriages...	per ft. sup.	1	3
Ditto, if mitred to cut string with return nosing, worked solid	each end	0	6
Ditto, if steps are dovetailed for balusters, including dovetail on baluster	each	0	4
Scroll brackets mitred to riser	,,	1	0
Curtail end to bottom step and fixed	,,	7	0
Housing to tread and riser	per ft. run	0	2
Returned moulding nosings to ends of steps, including mitres	,,	0	5½
1¼-in. string boards, wrought one side...	per ft. sup.	0	6
,, ,, wrought two sides	,,	0	8½
,, ,, add if moulded	,,	0	1
,, ,, add if cut for steps and risers ...	,,	0	2½
,, ,, add if mitred and cut ditto ...	,,	0	5
,, ,, extra only for ramps	per ft. run	0	6

String-boards are generally assumed to be 12 in. wide.

HANDRAILS.

Fixed, level or raking :—

Description.		Deal.		Oak.		Mah.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*
3 in. by 3 in. rounded	per ft. run	0	7	1	0½	1	2
4 in. by 3 in. moulded..................	,,	1	0	1	8½	2	0½
Scrolls for handrails......................	each	9	6	15	6	17	6
Joint, including screw and nut......	,,	1	6	1	10	1	10
Housing ends of 4 in. by 3 in. handrail, level	,,	0	4	0	4	0	4
Ditto, ditto, but on rake...............	,,	0	6	0	6	0	6
Housings in handrail to receive balusters.................................	,,	0	2	0	2	0	2½

Ramped handrail is worth 2 times straight.
Circular ,, ,, 2½ ,, ,,
Wreathed ,, ,, 4 ,, ,,

Labour on mahogany handrails equals 1½ times that on deal.

BALUSTERS.

Description.		Deal.		Oak.		Mah.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*
1-in. turned balusters, housed and fixed, 3 ft. long	each	1	0	1	7	1	11
1½-in. ditto, ditto, ditto	,,	1	2	1	11	2	4
2-in. ditto, ditto, ditto	,,	1	4½	2	5	2	10
Turning only balusters, ordinary pattern	,,	0	6	0	9	1	0
Ends of balusters dovetailed	,,	0	0½	0	0¾	0	0
Dovetails in steps for balusters if not otherwise taken..........................	,,	0	1	0	1¼	—	

NEWELS.

Description.		Deal.		Oak.		Mah.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*
3 in. by 3 in. wrought and framed, square	per ft. run	0	8	1	1	1	4
Above 3 in. by 3 in. ditto	per ft. cube	7	0	12	0	16	0
Turning only newels, in addition to price as square	each	1	0	1	6	2	6
Ditto, pendants..............................	,,	0	5	0	8	0	10

SKIRTINGS.

		s.	d.
$\frac{3}{4}$-in. by 7-in. deal torus moulded skirting and fixed	per ft. run	0	3
1-in. by 7-in. ,, ,, ,, ,,	,,	0	4
1-in. by 9-in. ,, ,, ,, ,,	,,	0	5
1-in. by 5-in. deal wrought o. s., square skirting, and fixed	,,	0	$3\frac{1}{2}$
1-in. by 9-in. ,, ,, chamfered ,,	,,	0	$4\frac{1}{2}$
Wrought and splayed grounds, 3 in. by $\frac{3}{4}$ in., including plugging to walls, grooving, &c.	,,	0	3
Mitred angles to skirting	each	0	$4\frac{1}{2}$
Ends fitted to architraves and chimney-pieces... ...	,,	0	3

Raking skirting is $\frac{1}{2}$ more than the price of straight.
Bent to curve ,, $1\frac{1}{2}$,, ,, ,,
Circular ,, 3 ,, ,, ,,

ROOFING FELT.

Inodorous asphalted roofing felt, including 2-in. laps, and fixed with iron clout nails, weighing 3 lb. per thousand, placed 3 in. apart	per square	9	0
Nails and labour in laying	,,	2	3

SHELVING.

1-in. wrought shelving and brackets, fixed ...	per ft. sup.	0	6
1-in. wrought louvre boards, fixed	,,	0	5

MOULDINGS.

4-in. by 1-in. architrave moulding from manufacturer, s. o.	per 100 ft. run	6	6
3-in. by 1-in. ,, ,, ,, ...	,,	4	6
$2\frac{1}{2}$-in. by $\frac{3}{4}$-in. ,, ,, ,, ...	,,	3	6
2-in. by $\frac{3}{4}$-in. ,, ,, ,, ...	,,	2	6
$3\frac{1}{2}$-in. to 5-in. girth, moulding, trade pattern ...	,,	17	6
$2\frac{1}{2}$-in. to 3-in. ,, ,, ,, ...	,,	16	0
$1\frac{1}{2}$-in. to 2-in. ,, ,, ,, ...	,,	7	6
3-in. by 2-in. moulded handrail ,, ...	,,	14	6
2-in. by 2-in., and under, special moulding, and fixed	per ft. cube	12	0
2-in. by 2-in. to 4-in. by 3-in. ,, ,,	,,	7	6
Over 4-in. by 3-in. ,, ,,	,,	6	0

Description.	Deal.		Oak.		Mah.	
	s.	d.	s.	d.	s.	d.
Capping, rounded or moulded, not exceeding 3 in. by 1 in., and fixed level or raking........................per ft. run	0	$4\frac{1}{2}$	0	6	0	7
Ditto, ditto, bent in fixing............ ,,	0	6	0	$7\frac{1}{2}$	0	9
Ditto, ditto, circular on plan......... ,,	0	9	1	0	1	2
Mitres to capping .... each	0	$0\frac{1}{2}$	0	$0\frac{3}{4}$	0	$0\frac{3}{4}$

Sundries.

		s.	d.
Boarding of floors, roofs, &c., taken up, clearing out nails, and removed to store	per square	3	0
Flooring timbers of ground floor, including joists, plates, clearing out nails, taken up and removed to store	,,	1	4
Ditto of upper floors, and ditto	,,	2	8
Ceiling joists taken down, nails cleared out, and ditto	,,	2	9
Framed roof, with tie-beam, purlins, &c., and ditto	,,	5	3
Girders taken down and removed to store	per ft. cube	0	4¼
Staircases, including tread and riser, with carriages, strings, and spandrel, taken down and removed to store	per ft. sup.	0	1¼
Shelving and brackets, ditto	,,	0	1
Oak saddles to doors up to 1½ in. thick, wrought, chamfered, and fixed	,,	2	0
Deal angle staff, square, sunk, ploughed, and plugged to wall	per ft. run	0	3
Ditto, bead, under 1½ in. diam., and ditto	,,	0	4
Skirting taken up and removed to store	,,	0	0¼
Doors and frames taken down and removed to store	each	1	6
Doors only ,, ,, ,,	,,	0	9
Frames only ,, ,, ,,	,,	0	10
Frames and sashes ,, ,, ,,	,,	1	9
Frames only ,, ,, ,,	,,	0	10
Sashes only (lower or upper) ,, ,,	,,	0	7
Shutters, in one height or width, ditto	,,	0	8
Sashes and frames, with linings, window-boards, architraves, and shutters, &c., taken down and removed to store	,,	3	6
W.C. fittings, deal, including seat, riser, flap, bearers, &c., ditto	per seat	2	6
Ditto, mahogany, ditto, ditto	,,	3	6
Large timber ends, pinned and wedged in wall ...	each end	1	0
Stout fir poles, 30 ft. long	each	4	6
Holes cut from 3 in. to 6 in. diam. or square, at per inch in depth	,,	0	6
Holes cut and dished to w.c. seat	,,	1	6
Cut feet to rafters	,,	0	3
Moulded ,, ...	,,	0	6
Memel door saddles, 9 in. by ¾ in., by 3 ft. long, and fixed	,,	1	3

Labour only in deal. For oak, mahogany, pitch-pine, and other hard woods, about double the following prices:

		s.	d.
Arris or small chamfer under ½ in. wide, straight	per 10 ft. run	0	1
,, ,, ,, circular ...	,,	0	2
Edges shot or wrought, under 3 in. thick, straight...	,,	0	2
,, ,, ,, circular...	,,	0	3
Rebating as for floor boards	,,	0	1½
Single beading, straight...	per ft. run	0	0¼
,, ,, circular	,,	0	0½

P 2

SUNDRIES—*continued.*

		s.	d.
Double or staff beading, straight	per ft. run	0	0½
,, ,, circular	,,	0	1½
Chamfering, not exceeding 2 in. wide, straight ...	,,	0	0¼
,, ,, ,, circular ...	,,	0	0½
Fair ends, not exceeding 3 in. thick	,,	0	0½
Flutes (each flute) any size	,,	0	1¼
Groove or plough, straight	,,	0	0¼
,, ,, circular	,,	0	1¼
Moulding, not exceeding 2-in. girth, straight ...	,,	0	1½
,, ,, ,, circular ...	,,	0	3
Rounded nosing, not exceeding 2 in. thick, straight	,,	0	0½
,, ,, ,, ,, circular	,,	0	1
Rebating, not exceeding 2-in. girth, straight ...	,,	0	0¼
,, ,, ,, circular ...	,,	0	1¼
Scribing, ,, ,, ,, ...	,,	0	0¼
Sinking, ,, ,, ,, ...	,,	0	1
Tonguing and grooving	,,	0	0½
Cross tonguing	,,	0	0¾
Cross or feather tonguing, including ploughing and tonguing	,,	0	2
Splayed cutting, and waste to 1¼-in. flooring ...	,,	0	1
Corners or ends rounded	each	0	3
Returned ends to mouldings, beads, nosings, &c. ...	,,	0	2½
Mitres to chamfers, nosings, mouldings, &c., under 2-in. girth	,,	0	1¼
Notches, not exceeding 6-in. girth	,,	0	0¾
Stops to mouldings, chamfers, nosings, grooves, &c.	,,	0	0½
Turning table-legs and similar articles	,,	1	1

SAWING.

		s.	d.
Hand-sawing in seasoned or old Baltic pine... ...	per square	4	4
,, American pine	,,	3	11
,, pitch-pine	,,	7	0
,, ash, beech, or elm	,,	6	1
,, Honduras mahogany	,,	6	1
,, Baltic or American oak	,,	6	7
,, English oak	,,	7	10
,, teak	,,	8	9
Ripping down old fir or deal, not exceeding 4 in. thick	per 10 ft. run	0	2
Ditto, oak, &c.	,,	0	3½
Sawing battens, 7 in. deep	,,	0	2½
,, deals, 9 in. deep...	,,	0	3
,, planks, 11 in. deep	,,	0	4

For machine sawing take half the foregoing rates.

PLANING.

		s.	d.
Planing by hand, straight	per square	8	0
,, ,, curved	,,	12	0
Planing by machinery, straight, 1½-in. boards ...	,,	1	9
,, ,, ,, 1¼-in. and under ...	,,	1	6

Planing on hard woods is one-third more than on fir.

Materials.

(SUPPLIED ONLY.)

		s.	d.
Chalk, dry, fine powdered, for felt roofing (barrels included)	per barrel of 2 bushels	3	6
Felt, inodorous or bituminous, in rolls 30 yds. run by 32 in. wide	per yd. run	0	8
Felt, patent asphaltic ditto ditto	,,	0	8
Felt, sarking or sheathing ditto ditto	,,	0	6
Nails for ditto, iron clout, 1 in. long	per 1,000	1	4
Coal-tar for felt-roofing, purified, in iron drums ...	per gallon	0	4
Deal fillets for floors, not exceeding 2 in. by $\frac{1}{4}$ in.	per 100 ft. run	3	0
Oak ,, ,, ,, ,,	,,	4	6
Glass-paper, sand or emery, ditto	per ream	16	0
,, ,, ,, ...	per quire	0	10
,, ,, ,, ...	per sheet	0	$0\frac{1}{2}$
Glue, best town made	per lb.	0	9
Glue, best Scotch, 65s. per cwt.	,,	0	7
Line, worsted, white or coloured, for blinds	per yd. run	0	$0\frac{3}{4}$
Line, patent sash, best white flax ,, ...	,,	0	1
Line, best plaited sash flax, No. 6, 100 strands ...	,,	0	8
Line ,, ,, No. 8, 140 strands ...	,,	0	10
Pencils, carpenters'	per doz.	0	8
Sawdust, white deal	per striked bushel	0	$2\frac{1}{2}$
Slag wool or silicate cotton slabs, 2 in. thick ...	per ft. sup.	0	$2\frac{1}{2}$
,, ,, ,, 3 in. thick ...	,,	0	4
Ditto, extra quality, 10 lb. per foot cube, and 200 ft. cube per ton	per ton	180	0
Ditto, ordinary quality, $12\frac{1}{2}$ lb. per foot cube, and 160 ft. cube per ton	,,	140	0
Tongues, deal, cross or feather	per 100 ft. run	6	0
,, oak, ,, ...	,,	9	0
Trenails, oak, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. diam., 5 in. to 8 in. long	per hundred	2	0
,, ,, 1 in. diam., 6 in. to 9 in. long ...	,,	2	9
Wedges, $\frac{1}{2}$ in. thick in centre, deal	per ft. sup.	0	$2\frac{1}{2}$
,, $\frac{3}{4}$ in. ,, ,, ...	,,	0	$3\frac{1}{4}$
,, 1 in. ,, ,, ...	,,	0	4
,, $1\frac{1}{4}$ in. ,, ,, ...	,,	0	$4\frac{3}{4}$
,, $1\frac{1}{2}$ in. ,, ,, ...	,,	0	$5\frac{1}{2}$
,, 2 in. ,, ,, ...	,,	0	$6\frac{1}{2}$

Double the above prices for oak wedges.

Nails.

		s.	d.
Steel, spike, 5 in. and 6 in. long	per lb.	0	2
,, ,, 7 in. to 10 in. ,, ...	,,	0	$1\frac{3}{4}$
,, rosehead, 1 in. long	,,	0	$2\frac{1}{2}$
,, ,, $1\frac{1}{4}$ in. ,, ...	,,	0	$2\frac{1}{4}$
,, ,, $1\frac{1}{2}$ in. ,, ...	,,	0	2
,, ,, $1\frac{3}{4}$ in. ,, ...	,,	0	$1\frac{3}{4}$
,, ,, 2 in. to $2\frac{3}{4}$ in. long	,,	0	$1\frac{1}{2}$
,, ,, 3 in. to 4 in. ,, ...	,,	0	$1\frac{1}{4}$
,, cut clasp, 1 in. long	,,	0	$2\frac{1}{4}$
,, ,, $1\frac{1}{4}$ in. ,, ...	,,	0	$1\frac{3}{4}$
,, ,, $1\frac{1}{2}$ in. ,, ...	,,	0	$1\frac{1}{2}$

NAILS—*continued.*

		s.	d.
Steel, cut clasp, 2 in. to 2½ in. long	per lb.	0	1¼
,, ,, 3 in. to 5 in. ,, ...	,,	0	1
,, wrought brads, ½ in. long	,,	0	5¼
,, ,, ¾ in. ,, ...	,,	0	3¾
,, ,, 1 in. ,, ...	,,	0	3¼
,, ,, 1¼ in. ,, ...	,,	0	3
,, ,, 1½ in. ,, ...	,,	0	2¾
,, ,, 2 in. ,, ...	,,	0	2½
,, ,, 2¼ in. and 2½ in. long	,,	0	2
,, ,, 3 in. long	,,	0	1¾
Sprigs, glaziers', ½ in. and ¾ in. long	,,	1	0
Tacks, Flemish black, ¼ in. to ½ in. long	,,	1	8
,, ,, tinned ,, ...	,,	2	0
Nails, brass-headed, strong, 1 in. to 1½ in. long ...	,,	0	1½
,, ,, ,, 2 in. to 3 in. ,, ...	,,	0	3
Iron clout, strong, 1 in. to 1¾ in. long	,,	0	3½
,, ,, 2 in. to 3 in. ,, ...	,,	0	2½
Copper, various, any size	,,	1	0
Composition, cast or gun-metal	,,	0	9
Wire, chequered head (mixed)	,,	0	0¾

SCREWS—FLATHEAD, ACCORDING TO GAUGE.

		Iron.						Brass.				
		s.	d.		s.	d.		s.	d.		s.	d.
½ in. long ...	per gross	0	8½	to	2	0	...	1	6	to	3	8
¾ in. ,, ...	,,	0	10	,,	3	0	...	1	10	,,	8	0
1 in. ,, ...	,,	1	0½	,,	5	0	...	2	9	,,	12	6
1¼ in. ,, ...	,,	1	3½	,,	6	0	...	3	3	,,	17	3
1½ in. ,, ...	,,	1	6	,,	10	6	...	4	0	,,	22	8
1¾ in. ,, ...	,,	1	10½	,,	15	0	...	5	3	,,	36	0
2 in. ,, ...	,,	2	0	,,	38	0	...	6	3	,,	50	0
2¼ in. ,, ...	,,	2	5	,,	40	0	...	7	0	,,	52	0
2½ in. ,, ...	,,	2	8	,,	42	0	...	10	0	,,	54	0
2¾ in. ,, ...	,,	3	4	,,	45	0	...	13	0	,,	60	0
3 in. ,, ...	,,	4	0	,,	46	0	...	14	6	,,	70	0

Wages, carpenter's	per hour	0	10½
,, joiner's	,,	0	10½
,, working foreman's	,,	1	2
,, horse, cart, and man	,,	1	5
,, carpenter's labourer	,,	0	7

MERCHANTS' QUOTATIONS FOR TIMBER.

The following are net cash prices, quoted by a well-known timber firm for goods offered in London Docks :—

SUPERIOR BUILDING QUALITY.

(Not less than 300 ft. of each sold, and not less than 500 ft. each of 2 × 4 and 2 × 3.)

in.	in.			s.	d.
4 ×	9	yellow	per ft. run	0	5½
4 ×	8	,, ...	,,	0	4¾
3 ×	11	,, ...	,,	0	4¼
3 ×	9	,, ...	,,	0	3¾

Superior Building Quality—*continued.*

in.		in.			s.	d.
3	×	7	yellow	per ft. run	0	2½
3	×	6	,, ...	,,	0	2
3	×	4	,, ...	per 100 ft.	9	6
3	×	3	,, ...	,,	6	6
2½	×	7	,, ...	,,	15	0
2½	×	6	white	,,	10	6
2	×	7	yellow	,,	12	6
2	×	6	,, ...	,,	8	6
2	×	5	,, ...	,,	7	0
2	×	4	,, ...	,,	6	0
2	×	4	white	,,	5	6
2	×	3	yellow	,,	4	8

Joinery Deals and Battens.

(Not less than 300 ft. of each sold.)

3	×	9	first yellow	per ft. run	0	4½
3	×	9	second ,, ...	,,	0	3¾
3	×	9	,, white...	,,	0	3
3	×	9	spruce	,,	0	3¼
3	×	6	first yellow	,,	0	2¼
2½	×	9	,, ,, ...	,,	0	3½
2	×	11	,, ,, ...	,,	0	3½
2	×	7	,, ,, ...	per 100 ft.	14	3

Superior Floorings and Matchings.

(Not less than 3 squares of each sold.)

1¼	×	6	T. & G. yellow flooring	per square	14	0
1	×	7	yellow flooring	,,	11	0
1	×	6	,, ,, ...	,,	11	0
1	×	6	white ,, ...	,,	9	9
1	×	4½	yellow ,, ...	,,	8	0
1	×	6½	best T. & G. flooring, discoloured by sea water	,,	9	0
⅞	×	6	white flooring	,,	8	9
⅞	×	5½	,, ,, ...	,,	8	3
1	×	5½	T. G. B. yellow	,,	10	6
¾	×	5½	,, ,, ...	,,	7	6
¾	×	4½	T. G. V. ,, ...	,,	7	6
⅝	×	6	T. G. B. ,, ...	,,	6	6
⅝	×	5½	,, ,, ...	,,	6	3
⅝	×	4½	,, ,, ...	,,	6	0
⅝	×	4	,, ,, ...	,,	5	0
½	×	5	,, white	,,	5	6
½	×	4	,, ,, ...	,,	4	9
½	×	3	,, ,, ...	,,	4	0

Planed Joinery Boards.

(Not less than 300 ft. of each sold.)

1¼	×	11	planed joinery boards	per 100 ft.	15	6
1¼	×	9	,, ,, ,, ...	,,	15	0
1	×	9	,, ,, ,, ...	,,	10	3
1	×	8	,, ,, ,, ...	,,	7	6
¾	×	9	,, ,, ,, ...	,,	7	6

Unplaned Boards, Etc.

(Not less than 500 ft. of each sold.)

in.	in.			s.	d.
1	× 6	unplaned boards	per 100 ft.	4	0
1	× 5	,, ,, ...	,,	3	3
$\frac{3}{4}$	× 6	,, ,, ...	,,	3	3
$\frac{5}{8}$	× 5	,, ,, ...	,,	1	9
$\frac{1}{2}$	× 4	,, ,, ...	,,	1	3
Yellow weatherboards 6 in. superior ...		... ...	,,	2	9
,, ,, 4 in.		... ...	,,	1	6

Slating Battens, Etc.

(Not less than 2,000 ft. of each sold.)

				s.	d.
$\frac{3}{4}$	× 2	slating...	per 100 ft.	1	1
$\frac{3}{4}$	× 1	tiling	,,	0	7

Laths (not less than one load sold) at 15*s*. per load of 9,000 ft.

Ironmongery.

The following are list prices from the catalogue of a well-known firm, from which deduct 20 per cent. trade discount. Add cost of screws, fixing, and 15 per cent. builder's profit.

Bolts.

Description.	3 in.	4 in.	5 in.	6 in.	8 in.	9 in.	10 in.	12 in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Japanned iron, tower, solid end ....each	0 2	0 $2\frac{1}{2}$	0 3	0 $3\frac{3}{4}$	0 5	—	0 $6\frac{1}{4}$	0 $7\frac{1}{2}$
Ditto, barrel, brass knob ,,	—	0 $3\frac{1}{2}$	—	0 $5\frac{1}{4}$	0 7	0 $7\frac{3}{4}$	0 $8\frac{1}{2}$	0 $10\frac{1}{2}$
Bright iron, square spring brass knob ,,	0 3	0 $3\frac{3}{4}$	0 $5\frac{3}{4}$	0 7	0 $11\frac{1}{2}$	—	1 $2\frac{1}{2}$	1 5
Brass barrel, medium .... ,,	1 5	1 7	1 11	2 3	3 3	4 0	4 6	5 0
Ditto, flush, sunk slide .. ,,	0 5	0 6	—	0 8	0 10	1 0	1 2	1 5
Ditto, cupboard, necked, strong .. ,,	0 6	0 9	0 10	0 11	—	—	—	—
Jap. malleable barrel door chains...... ,,	—	—	0 7	0 9	0 $11\frac{1}{2}$	1 1	1 2	—
Polished brass ditto, ditto.. ,,	—	—	3 9	5 6	7 0	8 0	15 9	—
Add screws only in fixing.... ,,	0 $0\frac{1}{2}$	0 $0\frac{3}{4}$	0 1	0 1	0 $1\frac{1}{4}$	0 $1\frac{1}{4}$	0 $1\frac{1}{2}$	0 $1\frac{1}{2}$
Add labour only fixing on deal ,,	0 3	0 3	0 4	0 4	0 5	0 5	0 6	0 6

		s.	d.
Cremone casement bolts, iron japanned, ¾-in. half-round, 6 ft. and under	each	5	0
Ditto, brass mountings, ditto...	,,	19	6
Ditto, all brass, ditto	,,	30	0
Espagnolette casement bolts, brass, ¾-in. round, 5 ft. and upwards	per ft. run	4	6
Ditto, iron, ditto	,,	2	6
Ditto, ormolu, ditto	,,	6	6
Fixing foregoing	each	2	6
24-in. monkey-tail bolt, ⅝-in. rod, japanned plate	,,	2	6
30-in. ,, ¾-in. ,, ...	,,	4	3
36-in. ,, ¾-in. ,, ...	,,	5	2
42-in. ,, ⅞-in. ,, ...	,,	7	6
Brass buttons on plates, 1½ in. to 2½ in.	,,	0	6
Iron cleats, line-fasteners, or belaying-pins, small, double hook	,,	0	3
Brass ditto, 3½-in., ditto	,,	0	6
Add for fixing last three items	,,	0	2
3-in. brass spring quadrant sash-fastener	,,	1	5
Add screws for fixing	,,	0	1½
Add labour ,, ...	,,	0	3½
Brass sash lifts, 2-in. hook, medium...	,,	0	2¾
,, ,, eyes, strong	,,	0	10
Brass casement fasteners, 3 in., ordinary pattern	,,	2	0
Iron ,, ,, ,, ...	,,	0	8
Malleable bow handles, 3½ in....	,,	0	4
Brass ,, ,, ...	,,	0	10
Brass flush drawer handles, 3½ in.	,,	0	9
Ditto projecting ,, ...	,,	0	8½
Add screws for fixing	,,	0	0¾
Add labour ,, ...	,,	0	3¼

HINGES.

Description.		2 in.		2½ in.		3 in.		3½ in.		4 in.	
		s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Cast-iron butt hinges, medium width......	per pair	0	2	0	2¾	0	3½	0	4½	0	5¼
Wrought, ditto, single joint	,,	0	5¼	0	6¼	0	8¼	0	10	1	0½
Ditto, double joint	,,	—		0	9½	0	11	1	3	1	6
Brass, ditto, medium...	,,	0	6¼	0	8¼	1	1	1	6	1	10
Cast-iron rising butts...	,,	—		0	7¼	0	8½	0	10½	1	1
Brass, ditto, medium...	,,	—		—		—		12	0	13	9
Wrought - iron parliament or external shutter hinges	,,	—		—		1	4	1	7	1	8
Brass, ditto, ditto	,,	—		—		3	0	3	6	4	8
Wrought-iron back flap hinges....................	,,	0	8½	—		—		—		—	
Brass, ditto, ditto	,,	2	1	3	3	—		—		—	
Fixing foregoing (hanging taken with doors)	,,	0	2	0	2	0	2½	0	3	0	3½

Description.	6 in.	8 in.	10 in.	1 in.	14 in.	16 in.	20 in.	24 in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
H hinges, wrought iron ....per pair	0 8½	0 11½	1 3	1 5	1 9	—	—	—
H L ditto, ditto, per pair	0 9½	1 1	1 5	2 2	2 6	—	—	—
Cross garnet or T hinges, W. I. per pair	—	0 7	0 8½	0 9¼	1 1	1 3	2 0	3 0
Strap hinges, wrought iron per pair	0 6½	0 9	1 1	1 8	2 5	—	—	—
Hook and eye, ditto .. per pair	—	—	—	—	—	—	3 0	5 0
Add, if fixed per pair	0 4	0 4	0 5	0 5	0 6	0 7	0 8	0 9

Description.	24 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Collinge's patent gate hinges, with spherical joints......per pair	9 0	12 0	15 0	19 0	22 0	25 0	28 0
For fixing to stone piers..........per pair	10 0	13 0	16 0	20 0	23 0	26 0	29 0
Add, if fixed ...... ,,	0 8	0 10	1 0	1 2	1 4	1 6	1 9
Bolts for ditto, 4½*d.* each ..	—	—	—	—	—	—	—

		s. d.
Smith's patent hinges, one spring and centre for one door 2 in. thick	per set	35 0
Add if fixed	,,	2 3

Hooks.

Description.		3 in.	4 in.	5 in.	6 in.	8 in.	10 in.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Iron cabin hooks and eyes	each	0 3½	0 4¼	0 5	0 5½	0 7	0 8
Brass ditto, ditto	,,	0 6¼	0 7¼	0 9¼	0 11½	1 4	1 6
Add if fixed.........	,,	0 2	0 2	0 3	0 3	0 5	0 6
Brass, single, wardrobe.........	,,	0 10½	—	—	—	—	—
Brass, double, wardrobe.........	,,	1 4	—	—	—	—	—

		s. d.
1½-in. knobs, iron japanned, screw	each	0 1½
,, brass, ,, ...	,,	0 3
,, hardwood, ,, ...	,,	0 3
Add if fixed	,,	0 2

Latches.

		s.	d.
Cast-iron stable-door latch, 4 in.	each	0	10½
Iron mortise stable-door latch, 4¼ in. by 3½ in. by ⅝ in. ...	,,	2	3
Wrought Suffolk, middling	,,	0	11½
,, ,, large	,,	1	3
Brass ,, middling	,,	5	0
Ditto ,, large	,,	8	0
Night latch, jap. iron, 2-bolt, strong, 4 in.	,,	3	6
Square plate latch, iron, 2-bolt, 4 in.	,,	1	2
Pulpit or closet latch, 1-bolt, strong, 3 in.	,,	3	1
Add for fixing Suffolk latches...	,,	0	5½
,, ,, other ,, ...	,,	0	6½

Locks.

Description.		6 in.	7 in.	8 in.	9 in.	10 in.
		s. d.	s. d.	s. d.	s. d.	s. d.
Wood stock lock, extra strong, fine plate	each	1 4	1 6	1 9	2 2	2 6
Iron rim dead-shot, fine ward, brass, strong......	,,	2 6	3 6	5 6	7 6	—
Iron rim draw-back, solid ward, with brass furniture	,,	—	4 6	5 3	6 6	8 3
Iron rim, fine ward, strong cranked tail, ditto	,,	2 7	3 3	5 2	—	—
Add if with Mace's strong furniture	,,	0 6	0 7	0 8	—	—
Rim lock furniture, strong brass, Mace's spindle...	per set	1 0	1 1½	1 3	1 5	1 7
Mortise lock (warded), two-bolt, solid brass ward, steel follower, without furniture	each	4 9	6 3	—	—	—
Mortise lock (lever), two brass bolt, two-lever, strong steel follower, palace motion, without furniture	,,	5 9	7 3	—	—	—
Ditto, but four-lever, ditto, best make.................	,,	10 0	11 9	—	—	—
Extra for half rebated ...	,,	1 3	1 3	—	—	—
Extra for full rebated ...	,,	6 0	6 0	—	—	—
Mortise lock furniture, 2-in. plain brass knob, Mace's spindle, extra strong	per set	2 6	2 6	—	—	—
Ditto, Mace's white porcelain ....per two-bolt set		2 3	2 3	—	—	—
Add labour for fixing stock locks	each	0 5	0 5	0 5	0 6	0 6
Ditto rim locks	,,	0 10	0 11	0 11	1 0	1 0
Ditto mortise locks	,,	1 3	1 5	—	—	—
Ditto furniture for locks	,,	1 0	1 0	1 0	—	—

LOCKS FOR FITMENTS.

Description.		2 in.	2½ in.	3 in.	3½ in.	4 in.
		s. d.	s. d.	s. d.	s. d.	s. d.
Iron cupboard locks, three-wheel tumbler, strong...	each	—	—	0 5	0 5¼	0 5½
Ditto, ditto, two-lever, brass bolt, strong	,,	—	—	1 11	1 11½	2 0
Cut cupboard locks, two-lever, strong (to differ)	,,	1 5	1 6	1 7	2 0	2 9
Till or drawer, ditto, ditto	,,	1 5	1 6½	1 9	—	—
Box or chest, ditto, ditto	,,	1 11	2 0	2 1	2 6	3 0
Brass cabinet, ditto, ditto	,,	1 11	2 0	2 1	2 6	3 0
Japanned iron padlocks, full warded tumbler ...	,,	1 2	1 3	1 4	—	—
Galvanised ditto, ditto ...	,,	1 6	1 9	2 0	—	—
Brass padlocks, two-lever, all brass, two keys, strong	,,	4 6	5 3	6 6	—	—
Add labour for fixing cupboard, drawer, or chest locks	,,	0 3	0 4	0 4	0 5	0 5

		s. d.
Hat and coat hooks, strong iron, 5 in. single	each	0 1
,, ,, strong brass	,,	0 9
,, ,, mall. iron, 7 in. double	,,	0 4
,, ,, strong brass	,,	1 1
Add for fixing foregoing	,,	0 1
Pivots and sockets for swing sashes, wrought iron ...	,,	0 3
,, ,, ,, ,, gun-metal ...	,,	0 9
Add for fixing	,,	0 3
Finger plates, plain oak, polished or dull	,,	1 0
,, ,, white china, 12 in. by 3 in.	,,	0 6
Add for fixing	,,	0 2
Letter plate, plain brass, for front door...	,,	5 9
Add for fixing, including cutting necessary hole in door	,,	1 6
Knocker, brass, plain pattern	,,	11 6
Screw pulleys, iron, with iron sheaves, 1½ in.... ...	,,	0 2½
,, ,, ,, ,, 2 in.	,,	0 3½
,, brass sheaves, 1½ in.	,,	0 9
,, ,, ,, 2 in.	,,	1 0
Fixing screw pulleys	,,	0 3
Axle or sash pulleys, iron frame, with brass face and wheel, 2 in.	,,	1 0
Add for fixing ditto	,,	0 3
Brass, medium, rack pulleys, 6 in.	,,	0 9½
Iron flush rings for stable doors on 3 in. by 2 in. plate	,,	1 0
Add for fixing ditto...	,,	0 6
Iron friction rollers, 1 in. wide, for sliding sashes or doors	,,	0 1½
Brass ,, ,, ,, ,, ,, ,,	,,	0 6
Add for fixing	,,	0 2
Casement stays, mall. iron, 12 in., to drop over pin ...	,,	0 9½
,, ,, ,, 18 in. ,, ,, ...	,,	1 6

		s.	d.
Casement, stays, brass, 12 in., to drop over pin ...	each	2	6
" " " 18 in. " " ...	"	3	0
Mall. iron flush shutter rings, 3 in.	"	0	5½
Brass " " " 2 in.	"	0	6
" " " " 3 in.	"	1	7
Iron rod door springs, strong, 18 in.	"	1	11
" " " 24 in.	"	2	4
Jap. iron patent helical door springs, 6 in.	"	3	0
Brass " " " "	"	5	0
Driving cranks for bell wires, 1 suite, 2 fly	"	0	5½
Leader " " "	"	0	10
Pillar " " " ...	"	1	0½
Copper wire	per lb.	1	2
Bells	"	1	0
Bell springs, single scroll, small	each	0	2½
" double "	"	0	5
1 in. tinned wire staples	per gross	0	2
1½ in. " "	"	0	5
1½ in. strong brass cup hooks	"	28	0
¾ in. brass picture rod	per ft. run	0	5
¾ in. iron " painted	"	0	4
Shelf brackets, iron, plain, 12 in. by 10 in.	each	0	8½
" " " 6 in. by 5 in.	"	0	3

ANALYSIS.

In this trade every builder should consult the *Timber Trades Journal*, a regular perusal of which will be of unlimited value. This paper gives the annual reports of the wood-brokers (who act as agents for the shipper), reviews of large timber sales, lists of shipping ports, marks and brands of timber, how sold, &c. It is only the timber merchant and big contractor who purchase at these public auctions, and the average builder usually buys from the former at the middleman's profit of from 5 to 10 per cent.

The principal ports of entry are London, Liverpool (for American wood), Hull, Grimsby, Bristol, Cardiff, &c.

Shippers' and quality marks on timber are constantly changing, sometimes from natural causes, and sometimes from dishonest reasons. Some are bracker's or sorter's marks, and some are private ones. Indeed, the question of brands, marks, and quality is in hopeless confusion, and it is useless for the ordinary builder to attempt to know more than what is sufficient to prevent himself from being defrauded. One writer states: "There is a great difference between the wood which different firms send out under the same denomination. The first quality of one firm may be no better than the second quality of another, and so the architect will ultimately have to approve or condemn the

material, not according to the marks on it, but according to its actual goodness or badness. Another point to be particularly noted is, that what the shipper calls 'second quality' the timber merchant calls 'first quality'; what the shipper calls 'third quality' the timber merchant calls 'second quality,' and so on."

Purchase and Delivery.—Prices of timber, as well as of other goods, depend very largely not only on the quantity required, but on the lengths, sizes of scantlings, &c., so that without a specification of requirements it is not possible to quote accurately.

All deals and battens taken from the docks are subject to a landing-rate charge as follows:—

	s.	d.	
On goods for immediate removal and sawing ...	3	9	per Petersburg standard.
If piled and awaiting orders	5	0	

There is no landing-rate on balk timber.

All timber under 9 in. square is landed on the wharves; 9 in. square and over lies in the timber ponds.

For timber loaded into barges the dock company charges 1*s.* per load for cranage, paid by purchaser.

For timber loaded on to timber carriages or other vehicles, the dock company charges 1*s.* 6*d.* per load for cranage, paid by purchaser. Timber purchased at dock sales is loaded by the company; outside labour to load into trucks costs 2*s.* or 2*s.* 6*d.* per Petersburg standard.

The foregoing and other dock charges are useful to the contractor who purchases at the large sales; but "If timber is not bought at auction, it would be bought at per load of the timber merchant, who would probably be also a proprietor of saw-mills. Another way commonly adopted by estimators is to send a timber merchant or saw-mill proprietor a copy of the carpenter's specifications, and contract with him to supply the timber, sawn to scantlings, for the whole of the requirements of the building at one uniform price. This is sometimes done at as low a rate as 1*s.* 6*d.* per foot cube; and it has not been an uncommon thing of late for a builder to price the whole of the timber in a bill of quantities as low as 2*s.* 2*d.*"—Leaning.

Deals are carted from the docks to the City at 13*s.* per Petersburg standard, or say 1*d.* per foot cube. The loading and unloading is paid by the importer, as a part of the dock charge.

Balk timber is similarly carted for 6*s.* per load of 50 cubic feet. This is rather less than 1½*d.* per foot cube. Only the cartage from docks to saw-mills need be reckoned, as the proprietors of the latter do not charge for delivery of stuff, after sawing, to any place within three miles of their mills.

If the builder has not got the machinery for converting timber himself, he can arrange with the owner of a saw-mill for its removal from the docks, sawing, and delivery on the site.

Carriage.—Timber is carried by computed, and not actual, weight. Fir timber is charged as 50 ft. cube to the ton, and hardwood as 40 ft. cube.

The railway rate for carriage of timber is something like 2½*d.* per mile per load of 50 c. ft. for a distance of about fifty miles, and 2*d.* per mile ditto for 100 miles. The weight of a St. Petersburg standard of unplaned planks and boards is calculated and charged by all railway companies at 2½ tons per standard.

Measurement.—In London the sectional area of square timber is measured by means of the Custom House caliper measure; but in Glasgow, Dublin, and other home ports the solidity is taken by string measurement—by girthing the centre of the balk with string, and squaring one-fourth of the length of the string multiplied by length of balk. This is the measurement of round timber when barked.

Sawing.

In the conversion of timber to its final form on a building the first thing to be considered is the valuation of the sawyer's work. The amount of this varies immensely according to whether

1. The scantlings can be selected out of imported sizes requiring no sawing;
2. The scantlings can be obtained out of "deal," which only requires a minimum of sawing;
3. The scantlings must be sawn out of balk timber, which necessitates a maximum of sawing.

So many different scantlings are imported nowadays, that if the architect knows his business he can easily specify sizes which are most convenient for the builder to get, and which will therefore reduce the cost of sawing and ultimate conversion; otherwise there will be much waste and expense in sawing these out of large balk timbers. By "deal" is meant planks, deals, and battens, which come into the market in sizes from 4 in. to 12 in. wide, and 1 in. to 4 in. thick.

Sawing is divided into hand-sawing and machine-sawing.

Hand-sawing is only resorted to when it is not worth while for the builder to send small quantities of stuff to the saw-mills to be cut up, and when it will serve the same purpose to do the job himself. Entailing considerable manual labour, it is, of course, very troublesome, and costs twice as much as mill-sawing. In the case of deep cuts with the grain, and through the width of the wood, sawing is paid for by the 100 ft. super., or by the 10 or 100 ft. run, if the wood is 4 in. thick or under. The former is termed "deeping" (deep cut), and the latter "flatting" (flat cut), or sawing through the thinnest way of the boards. There will also be cross cuts, or against the grain of the wood, in cutting to required lengths, which are paid for by the number.

Dry seasoned timber takes longer to saw than new stuff freshly imported, and the cost of sawing is about one-fourth more than that for the latter. The value of sawing on teak and mahogany is two to three times that on fir, and on oak, elm, ash, and beech about twice as much again as on fir. As a cut produces two faces, each separate face would be *half a cut*, and the labour to each surface would be "half-sawing." The cut itself is called the saw-kerf, for which $\frac{1}{8}$ in. is generally allowed, which must be taken into account when converting timber.

As hand-sawing would be executed by a carpenter at $10\frac{1}{2}d.$ per hour, its valuation per square can be worked out as below. The prices represent whole sawing for old stuff.

A carpenter will saw—					*s.*	*d.*
100 ft. super. of	Baltic pine	... in 5 hrs.	× $10\frac{1}{2}d.$	=	4	4
,,	American pine ...	... in $4\frac{1}{2}$,,	× $10\frac{1}{2}d.$	=	3	11
,,	pitch-pine	... in 8 ,,	× $10\frac{1}{2}d.$	=	7	0
,,	ash, beech, or elm...	... in 7 ,,	× $10\frac{1}{2}d.$	=	6	1
,,	Honduras mahogany	... in 7 ,,	× $10\frac{1}{2}d.$	=	6	1
,,	Baltic or American oak	... in $7\frac{1}{2}$,,	× $10\frac{1}{2}d.$	=	6	7
,,	English oak ...	... in 9 ,,	× $10\frac{1}{2}d.$	=	7	10
,,	teak	... in 10 ,,	× $10\frac{1}{2}d.$	=	8	9

The time given is based on the constants in Hurst's "Surveyor's Pocketbook," and is presumably for dry or old timber.

Example.—What will be the cost of sawing by hand a 12 in. by 12 in. seasoned balk of pitch-pine 30 ft. long into $\frac{3}{4}$ in. boards?

Allowing $\frac{1}{8}$ in. for each saw-kerf, we get 14 boards, each $\frac{3}{4}$ in. thick, and 13 whole cuts, as every board will have an equivalent to one-half cut on either side—*i.e.*,

$\frac{3}{4}$ in. + 2 ($\frac{1}{16}$ in.) = $\frac{7}{8}$ in. for each board and each whole cut together. The number of cuts is one less than the boards.

∴ 30 ft. run by 12 in. wide = 30 ft. super. of 1 cut.
And 30 ft. super. by 13 cuts = 390 ft. super. of total sawing.
And 390 ft. super. sawing at 7*s.* per 100 ft. super. = £1 7*s.* 4*d.*, answer.

Machine-sawing is much superior to hand-sawing—more precise, and can be done for about half the price. Circular-saws, band-saws, jig-saws, and vertical-saws are employed. Of these a properly constructed band-saw will cut very nearly as fast as the best circular-saws, while wasting fully 70 per cent. less wood in each cut, producing a much smoother surface, and taking only half the power to drive it. In machine work little allowance need be made for the saw-cut, about $\frac{1}{10}$ in. For small shops, where there are less than twenty joiners, it is more economical and advantageous to employ a combined machine, such as a "General Joiner," which not only executes sawing but also performs the operations of planing, moulding, grooving, tenoning, mortising, and boring.

Example.—What will be the cost of sawing up by steam-power two dozen 9-in. by 3-in. deals, each 12 ft. long, into $\frac{1}{2}$-in. boards at the rate of 80 ft. super. of band-sawing per horse-power per hour? Coals 13*d.*, man 7*d.*, incidentals 2*d.*, = 22*d.* per hour.

To yield $\frac{1}{2}$-in. boards the 3-in. thickness of deal would require four cuts, producing five boards out of each piece of deal. Each cut would be 12 ft. long by 9 in. wide.

24/4/12.0
∴ ·9
—— 864 ft. super. of sawing required.

And $\frac{864}{80}$ = say 11 hours at 22*d.* = £1 0*s.* 2*d.*, answer.

Also, if 80 ft. super. cost 22*d.*, the cost of 100 ft. super. will be—

$$22d. \times \frac{100}{80} = 2s.\ 3\tfrac{1}{2}d.$$

Mill Charges for Sawing.

	s.	d.
Baltic fir under 12 in. square, 3 cuts to the load of 50 ft. cube	7	6
,, 12 in. and over, 4 cuts ,, ,,	7	6
,, sawing per 100 ft. super....	4	0
Cross cuts, each	0	4
Cutting 4-in. arris rail per 100 ft. run	2	0
,, 5-in. ,, ,, ...	2	3
Fir scantlings, 6 in. and under, per ft. run	0	0¼
,, above 6 in. ,, ...	0	0½
Cartage, per load of 50 ft. cube, per mile	1	0

BATTENS, DEALS, AND PLANKS.

Length.	Battens.	Deals.	Planks.
	Per doz. cuts.	Per doz. cuts.	Per doz. cuts.
ft.	*s. d.*	*s. d.*	*s. d.*
6	1 4	1 6	2 0
7	1 6	1 9	2 3
8	1 8	2 0	2 6
9	1 10	2 3	2 9
10	2 0	2 6	3 0
11	2 2	2 9	3 3
12	2 3	3 0	3 6
13	2 4	3 3	3 10
14	2 6	3 6	4 3
15	2 8	3 9	4 9
16	2 10	4 0	5 0
17	3 0	4 3	5 3
18	3 3	4 6	5 6
19	3 6	4 9	6 0
20	3 9	5 0	6 3
21	4 0	5 3	6 6
22	4 3	5 6	7 0
23	4 6	5 9	7 6
24	4 9	6 0	8 0
25	5 0	6 3	8 6
26	5 3	6 6	9 0
30	6 3	7 6	11 0

		s.	*d.*
Flatting, 3 in. and under...	per 100 ft. run	1	0
,, 4 in. ,, ...	,,	1	4
Pine planks above 11 in. wide	per 100 ft. sup.	3	6

HARDWOODS.

Mahogany, Honduras ...	per 100 ft. super., under 24 in. deep	6	3
,, Spanish	,,	7	6
Teak	,,	8	0
Yellow pine	,,	5	0
Pitch-pine	,,	6	0
Wainscot	,,	6	0
American ash and whitewood	,,	6	0
American oak, elm, and black walnut	,,	7	0
English oak, beech, elm, ash, and chestnut	,,	7	0
Cross cuts, ash	each	0	6
,, mahogany	,,	0	9

Cartage charged on seven cuts and under at 7*s.* 6*d.* per ton of 40 ft. cube.

The foregoing prices for sawing include collection from docks and delivery after sawing within three miles of mills, except the extra charges for cartage and landing rate.

Planing, Matching, &c.

Labours, all at per 100 ft. super.: –	$1\frac{1}{4}$ in. and under s.	d.	$1\frac{1}{2}$ in. s.	d.
Sawing and planing...	2	3	2	6
,, ,, and grooving...	3	0	3	3
,, ,, both sides ...	3	9	4	0
,, ,, ,, and matched ...	4	6	4	9
,, ,, and plain matching...	3	3	3	6
,, ,, matched and beaded or chamfered	3	9	4	0
,, ,, ,, ,, both sides ...	5	0	5	3
Planing boards, when sawing charged separately ...	1	6	1	9
Grooving prepared boards at yard ...	1	6	1	9
Prepared boards, grooved or beaded ...	1	9	2	0
,, ,, matched only ...	2	0	2	3
,, ,, matched and beaded ...	2	3	2	6
,, ,, rebated and beaded only ...	2	6	2	9
Sawing, edging, and thicknessing...	2	3	2	6
,, ,, ,, and grooving...	2	6	2	9

Stacking 3*d*. per square extra.

All the foregoing are nominal sawmill charges, and are liable to modification or discount. For complete lists of rates it is best to apply to the various sawmills.

The quantity of sawing required, as previously stated, depends upon whether the scantlings are obtained from exact imported sizes, from deals, or from balk timber. The amount of sawing also varies with the class of structure, for it decreases with the increase in the size of the timbers.

Leaning shows, by a series of calculations from actual buildings, that an average of some 360 ft. super. of whole sawing is required per load of 50 c. ft. if the scantlings are cut out of balk timber, and that only 145 ft. super. are required per load if obtained from deal, or imported sizes which need little conversion.

Timber per Load.

Carpenters' work, such as girders, joists, plates, &c., is executed partly from balk timber and partly from deal timber, and the basis of calculation would be by the load of 50 c. ft. Joiners' work, on the other hand, is generally converted out of deal, with the St. Petersburg standard as the usual criterion.

For the former it is usually specified that "the fir timber, unless otherwise described, to be from Memel, Riga, or Dantzic, or of such approved kind as may be ordered. The quality to be equal to that known as 'best middling,' to be free from large or loose knots, and other defects." The timber is also specified to have "all sides sawn die-square

with sharp angles." As before mentioned, the builder can often get the same sizes and better stuff out of imported scantlings or deal, which need little or no sawing, and so evade that labour.

The average prices per load of 50 c. ft. of squared timber, bought by the contractor at the large dock sales, are as follows:—

	£	s.	d.		£	s.	d.
Best Dantzic fir timber	4	10	0	English oak	4	10	0
Best middling ,, ...	4	5	0	Dantzic and Memel oak	5	0	0
Good middling ,, ...	4	0	0	Riga wainscot oak ...	4	0	0
Pitch-pine	3	10	0	Quebec oak	6	10	0
American red pine ...	4	0	0	Teak, Burmah	14	10	0
American yellow pine...	5	0	0	Greenheart	8	0	0
Small Swedish fir ...	2	0	0				

As before mentioned, there is no landing-rate charge for balk timber.

After purchase the balks are taken to the mills, slabbed all round, then sawn up into the sizes required and cross-cut. The waste of stuff per load in slabbing averages 30 per cent., ditto sawing die-square, from saw-kerfs, $7\frac{1}{2}$ per cent., and ditto in cross-cutting $2\frac{1}{2}$ per cent. Laxton says: "Add to the price at the yard £1 per load for sawing and carting," but this is a mere rule-of-thumb, and seems insufficient. Bearing in mind previous statements, the particulars of the total cost would then appear:—

Analysis of Cost of Balk Timber.

	£	s.	d.
One load of 50 ft. cube best middling Dantzic	4	5	0
Cartage from docks to sawmills	0	6	0
30 per cent. waste on £4 5s. for slabbing	1	5	6
$7\frac{1}{2}$,, ,, ,, sawing die-square	0	6	$4\frac{1}{2}$
$2\frac{1}{2}$,, ,, ,, cross-cutting to lengths ...	0	2	$1\frac{1}{2}$
360 ft. super. of whole sawing for scantlings at 4s. per 100 ft. super.	0	14	5
50)	6	19	5
Net price per foot cube, delivered on site	0	2	10

The profit is added on each detailed item further on.

If, however, the builder can get all his sizes for carpenters' work out of deal timber or imported scantlings, the labour of sawing would be largely saved, and the analysis would be as follows: Suitable deals would cost about £10 per St. Petersburg standard of 165 ft. cube, which is equivalent to £3 0s. 7d. per load of 50 ft. cube, or a little under

35 per cent. cheaper than balk timber. The waste will also be less.

ANALYSIS OF COST OF DEAL TIMBER.

	£	s.	d.
1 load of deal at £3 0s. 7d. (or £10 per standard)	3	0	7
Cartage from docks to sawmills	0	6	0
$2\frac{1}{2}$ per cent. waste on £3 0s. 7d. for cross-cutting to lengths	0	1	6
145 ft. super. of sawing for conversion at 4s. per 100 ft. super.	0	5	$9\frac{1}{2}$
	50)3	13	$10\frac{1}{2}$
Net price per foot cube, delivered on site	0	1	7

As a matter of fact the carpenter's work is derived from both balk and deal timber, and the proportion of each kind depends upon the style of building. It would, therefore, be a great convenience to evolve a price which would embody both, and which would be applicable to most cases. This proportion would be approximately one-third balk and two-thirds deal, and such a price may be ascertained thus:—

	s.	d.
2s. 10d. price of balk timber by $\frac{1}{3}$	0	$11\frac{1}{4}$
1s. 7d. ,, deal ,, by $\frac{2}{3}$	1	$0\frac{3}{4}$
Price per ft. cube, delivered on site	2	0

Timber merchants will supply whole or half fir timbers in various lengths up to 45 ft. at a standard rate (say, 1s. 6d. per ft. cube) if the *average* length does not exceed 27 ft. Should the average of any lot exceed 27 ft. by any given number of feet, that number will be the number of shillings per load of 50 c. ft. extra charge which will be made. Say the average length is 34 ft., then the excess is 7 ft., and the price is 7s. per load dearer than if the average had been 27 ft. or under. Approximately the extra charge is $\frac{1}{4}$d. per foot cube on all the timber for each cubic foot the average is in excess of 27 ft.

DEALS PER STANDARD.

The carpenter having supplied all the rough and heavy woodwork which is generally hidden, the joiner executes the lighter framed stuff, fittings exposed to view—such as doors, windows, &c.—which are prepared, ready for fixing, at the workshops. Consequently joinery should be made from the best material. Nowadays the carpenter is only regarded as being capable of doing the rougher kinds of work—such as joisting, roofing, centres, &c.—prepared at the site. On the

contrary, the joiner is a more skilled workman, but is threatened by machinery and machine-made joinery to be transformed into a wood-fitter. Like other trades, the joiner's is often sub-let.

Specifications run: "The deals, excepting when stated to the contrary, are to be yellow Christiania, best Petersburg, or Archangel of the first quality, or Baltic red, as may be ordered, and equal in quality to first-class goods of the best Russian or Swedish shipment, and to be well-seasoned, and supplied in such lengths and of such breadths as shall be directed." For really high-class joiners' work there are no better deals than the best St. Petersburg, as sent over by Messrs. Gronoff; the best Archangel, as shipped by a firm like Brandt's; or the best Onega, as supplied by the Onega Wood Co.

The basis of calculation will be the St. Petersburg standard of 120 deals, 12 ft. × 11 in. × $1\frac{1}{2}$ in. = 1,320 ft. super. of $1\frac{1}{2}$ in. thick, or 165 ft. cube. Other sizes are reduced to this criterion; but as deals are sold in various other ways, the matter is so confusing that tables for timber calculation are almost indispensable, or the estimator must work out the sum on paper.

The best deals cost at the dock sales on an average :—

		£	s.	d.
Swedish	per standard	15	0	0
Best St. Petersburg	,,	13	0	0
Quebec yellow pine, first brights	,,	25	0	0
Canadian spruce, firsts	,,	14	0	0

There must also be taken into account 3*s.* 9*d.* for landing-rate on goods for immediate removal and sawing, 1*s.* 6*d.* for loading, 13*s.* for cartage, cost of sawing into thicknesses, and 10 per cent. waste in sawing and conversion. The cost of sawing would depend upon the thickness and lengths of boards required, and may be kept separate if convenient. If $\frac{1}{2}$-in. boards were wanted, this would mean two cuts down the breadths of 120 planks, 12 ft. × 11 in. × $1\frac{1}{2}$ in., or 120 × 2 = 240 cuts, 12 ft. long by 11 in. wide = 20 doz. at 3*s.* 6*d.* per dozen.

Analysis of Cost of Deals.

	£	s.	d.
1 standard of 1,320 feet super. of best St. Petersburg deal ...	13	0	0
Landing rate at docks	0	3	9
Loading ,, ...	0	1	6
Carried forward	13	5	3

ANALYSIS OF COST OF DEALS—*continued.*

	£	s.	d.
Brought forward	13	5	3
Cartage from docks to sawmills	0	13	0
Sawing into ½-in. thicknesses 20 doz. cuts at 3*s*. 6*d*.... ...	3	10	0
10 per cent. waste in sawing and conversion on £13... ...	1	6	0
3,960)	18	14	3
Net price per foot super. ½ in. thick, delivered on site	0	0	1¼

In this case, as three thicknesses were cut out of the standard thickness of 1½ in., the divisor stood 1,320 × 3 = 3,960. By altering this divisor in a similar manner the prices per foot super. for other widths and thicknesses can be easily calculated. If there is a large quantity of sawing the sawmill owners will include the cost of cartage from the docks in their rates, and collect the timber themselves, as well as deliver it. And if the builder keeps the wood two years or more for seasoning he will have to insert in the foregoing analysis the interest for that time on its outlay, or else reckon it among his establishment charges.

"It is necessary that the student of estimating should exercise himself in such questions as how to obtain the cost of timber sold by standard measure. He should, for instance, be able to find out the value of deals at the price per standard.

Let us take an example :—

1 std. 16 deals at £10 10*s*. per standard.

The deals will always be found to work out at 2*d*. to each standard pound. Thus in £10 10*s*. 0*d*., the price of a standard, there is just 21 pence, which, when multiplied by the number of deals over, 16, will give their value; as, for example:

£10 10 0 per standard
2
―――
21 pence
16 deals
―――
12)336 pence
―――
28*s*. cost of 16 deals

	£	s.	d.
Cost of one standard	10	10	0
Cost of sixteen deals	1	8	0
Total cost	11	18	0

Again, to find the number of lineal feet in a standard of any scantling, multiply the thickness by width and divide 23,760 by the product, thus:—

Suppose we wish to find the number of lineal feet in a standard of $2\frac{1}{2}$ in. by 8 in., then—

$2\frac{1}{2}$ in. $\times$ 8 in. $=$ 20, and 23,760 $\div$ 20 $=$ 1,188 ft. lineal.

If we require to obtain the value of any number of feet in a standard of £12 per standard, say 124 ft. of $3\frac{1}{2}$ in. by 2 in.—

$3\frac{1}{2}$ in. $\times$ 2 in. $=$ 7 sq. in., 124 ft. $\times$ 7 $=$ 8·68 $=$ $8\frac{68}{100}$ shillings $=$ 8*s.* $8\frac{1}{4}$*d.*

In this case the product will give shillings in the hundredths place and fractions of shillings in the tens and units place. By adding the difference between the £12 standard and any other price, the value of any number of feet at any price per standard may be obtained. Of course, most price books give tables of the value of running feet. A table of the equivalent prices per cubic foot and St. Petersburg standard is especially necessary in pricing."—Author of "Estimates."

Planing.

Specified sizes usually imply, unless otherwise stated, those sizes less the waste caused by the wrought faces. If "finished sizes" are mentioned, then rough timbers $\frac{1}{8}$ in. larger each way must be taken to allow for the loss in planing, although in bills of quantities it is generally specified that: "In taking dimensions of joiner's work, $\frac{1}{16}$ in. will be allowed for each wrought face." For finished thicknesses in deal add 1*d.* per foot super. to prices for nominal thicknesses. Boarding is invariably machine-planed at the sawmills, and only requires subsequent smoothing, while timbers are bought rough by the builder and afterwards planed, as may be necessary, by his carpenters.

For prices of machine-planing, grooving, &c., see p. 227. This is usually assumed at $\frac{1}{2}$*d.* per foot super. for fir or pine, though when taken by the larger dimension of per square the valuation is much less.

When planing is done by hand, a carpenter can execute 100 ft. super. per day of 9 hours × $10\frac{1}{2}$*d.* per hour. That is 100 ft. super. cost 8*s.* = 1*d.* per foot super.

If circular work, two-thirds of this quantity can be performed, or $1\frac{1}{2}$*d.* per foot super.

If performed by machinery, and smoothed or finished by the carpenter, allow $\frac{3}{4}d.$ per foot super. for straight planing. Planing on hardwoods is one-third more than on fir.

Various Labours.

The following are some constants of labour for ordinary work on fir, which have been extracted from the treatises of Leaning, Hurst, and Fletcher. Labour on hardwoods may be generally taken at twice such values. These constants represent the theoretical time, and the practical estimator seldom employs them.

		Hours of a Carpenter.
Labour fixing plates, lintels, &c. (bedding taken in bricklayer)	per ft. cube	·40
Ditto, ground joists...	,,	·50
Ditto, framed bridging joists and trimmers	,,	·66
Ditto, quarter-partitions, tenoned	,,	1·00
Ditto, ,, and trussed	,,	1·23
Ditto, fixing fir in roofs	,,	·90
Ditto, in roof trusses, exclusive of hoisting	,,	1·23
Ditto, in ceiling joists	,,	1·00
Ditto, to fir, wrought and framed	,,	2·28
Ditto, ,, and rebated	,,	3·15
Ditto, ,, ,, and beaded	,,	3·30
Ditto, ,, proper door casings	,,	3·70
Chamfers, 1 in. wide and under, straight, labour only...	per ft. run	·02
,, ,, cross-grain ,, ...	,,	·03
,, ,, circular ,, ...	,,	·03
Beads, ,, straight ,, ...	,,	·03
,, ,, cross-grain ,, ...	,,	·05
,, ,, circular ,, ...	,,	·06
Staff beads, ,, straight ,, ...	,,	·09
,, ,, cross-grain ,, ...	,,	·12
,, ,, circular ,, ...	,,	·15

If foregoing are stopped, increase constant by one-half.

Cutting, 2 in. thick and under, raking, labour only ...	per ft. run	·06
,, ,, circular ,, ...	,,	·09
Groove, plough, straight, ditto	,,	·03
Notching or scribing, 1 in. and $1\frac{1}{4}$ in., ditto	,,	·09
Plugging, labour only	,,	·08
Rebates, not exceeding 2 in. girth, straight, labour only	,,	·03
,, ,, cross-grain ,, ...	,,	·09
,, ,, circular ,, ..	,,	·12
Rounded edges, ,, straight ,, ...	,,	·06
,, ,, circular ,, ...	,,	·09
Edges shot, 1 in. and under	per 100 ft. run	·70
,, over 1 in. to 2 in.	,,	1·00
Mouldings, 2 in. girth and under, straight, labour only	per ft. run	·12
,, ,, cross-grain ,, ...	,,	·18
,, ,, circular ,, ...	,,	·24
,, over 2 in. girth, straight, labour only ...	per ft. sup.	·72
,, ,, cross-grain ,, ...	,,	1·08

		Hours of a Carpenter.
Mouldings, over 2 in. girth, circular, labour only	per ft. sup.	1·44
Ditto, including double architraves ,,	,,	1·00

If foregoing are stopped, increase the constant by one-half.

Battening, including plugging to wall, ¾ in. to 1¼ in., at 12 in. centres	per square	2·60
Fixing only, ¾ in. rough boarding to roofs, edges shot, straight	,,	3·00
,, 1 in. ditto	,,	3·30
,, 1¼ in. ditto	,,	3·80
,, slating battens for Countess slating	,,	2·00
,, inodorous felt to roofs	,,	1·50
,, sound boarding and fillets	,,	8·00
,, centring to vaults	,,	10·00
,, centring to concrete floors	,,	6·00
,, gutter boards and bearers	per ft. sup.	·30
,, centring to trimmer arches	,,	·30
,, ,, to openings	,,	·30
,, bracketing for cornices	,,	·24
,, centring to 4½ in. soffits	per ft. run	·11
,, ,, 9 in. ,,	,,	·24
,, rough fillet	,,	·03
,, eaves fillet	,,	·06
,, rolls for lead	,,	·09
,, herring-bone strutting to 9 in. joists	,,	·14
,, ,, ,, 9 in. to 12 in. joists	,,	·17
,, grounds for skirtings, &c.	,,	·05
,, ,, framed	,,	·08
,, fascias or skirtings, 6 in. and under	,,	·10
,, ,, 6 in. to 9 in.	,,	·13
Framed partitions, 1½ in. square-framed	per ft. sup.	·50
,, ,, ,, add if moulded, o.s.	,,	·10
,, ,, ,, ,, B.S.	,,	·20
Labour from bench, 1 in. shelves, wrot. B.S., no bearers	,,	·20
W.C. flaps and frames, fixing and hanging	,,	·16
Shutters, 1 in. deal, two-panel, square-framed	,,	1·00
,, add for every extra panel	,,	·20
,, add if bead-butt or moulded, o.s.	,,	·18
,, add if hung in two heights	,,	·12
Skirtings, including backings, &c., fixed complete, ¾ in.	,,	·35
,, 1 in.	,,	·40
,, add if beaded or chamfered	,,	·08
,, add if torus moulded	,,	·15
Window backs, elbows, and soffits, 1 in. deal, two-panel	,,	·70
,, add for each extra panel	,,	·09
,, add if bead-butt or moulded	,,	·10

Other constants are given further on with various items of work.

A carpenter will take 3 hours to scarf a joint, 18 in. long, in an 8 in. by 5 in. purlin.

Ditto, 1 hour, ditto, 7 in. by 1½ in. ridge.

Ditto, 1 hour to prepare 12 ft. run of 4½ in. by 3 in. (about 1 f.c.) wall-plate, ready for bricklayer to bed.

Nails and Screws.

Nails.—It will be convenient to consider here the cost of nails and screws before proceeding to the question of fixing woodwork. Steel nails are the best, and "cut clasp" are mostly used. Their uniformity of size and make, with freedom from waste, renders them cheaper to use, especially as their price is but slightly in excess of iron ones. As a general rule, the lengths are determined by taking rather more than twice the thickness of wood to be fixed. For instance, $1\frac{1}{4}$ in. flooring would require $2\frac{3}{4}$ in., or even 3 in. nails. This custom, however, applies more to boarding, and would be modified in the case of scantlings of considerable size. The following lists will indicate the lengths, weights, and net prices at a glance. It will be observed that the smaller the nail the higher the price per cwt. When nails are nominally sold by the thousand it will be found in practice that, if counted, the "thousand" varies from 800 to 900 only. Allow 5 per cent. for waste in fixing.

Nails, Steel.

			Per 1,000.			Per Cwt. s.	d.		Per Lb. d.
Spike	5	in. weigh	190	lb.	and cost	18	6	or	2
,, ...	6	,,	262	,,	,,	17	6	,,	2
,, ...	7	,,	375	,,	,,	17	0	,,	$1\frac{3}{4}$
,, ...	8	,,	525	,,	,,	16	6	,,	$1\frac{3}{4}$
,, ...	9	,,	626	,,	,,	16	0	,,	$1\frac{3}{4}$
,, ...	10	,,	900	,,	,,	15	9	,,	$1\frac{3}{4}$
Rosehead	1	,,	3	,,	,,	24	0	,,	$2\frac{1}{2}$
,, ...	$1\frac{1}{4}$	,,	4	,,	,,	21	0	,,	$2\frac{1}{4}$
,, ...	$1\frac{1}{2}$	,,	5	,,	,,	18	0	,,	2
,, ...	$1\frac{3}{4}$	,,	7	,,	,,	15	6	,,	$1\frac{3}{4}$
,, ...	2	,,	10	,,	,,	14	6	,,	$1\frac{1}{2}$
,, ...	$2\frac{1}{4}$	,,	13	,,	,,	14	0	,,	$1\frac{1}{2}$
,, ...	$2\frac{1}{2}$	,,	16	,,	,,	13	3	,,	$1\frac{1}{2}$
,, ...	$2\frac{3}{4}$	,,	21	,,	,,	12	9	,,	$1\frac{1}{2}$
,, ...	3	,,	24	,,	,,	12	6	,,	$1\frac{1}{4}$
,, ...	$3\frac{1}{4}$	,,	28	,,	,,	12	3	,,	$1\frac{1}{4}$
,, ...	$3\frac{1}{2}$	,,	32	,,	,,	12	0	,,	$1\frac{1}{4}$
,, ...	$3\frac{3}{4}$	,,	36	,,	,,	11	9	,,	$1\frac{1}{4}$
,, ...	4	,,	40	,,	,,	11	6	,,	$1\frac{1}{4}$
Cut clasp	1	,,	$1\frac{3}{4}$	,,	,,	20	0	,,	$2\frac{1}{4}$
,, ...	$1\frac{1}{4}$	,,	3	,,	,,	15	0	,,	$1\frac{3}{4}$
,, ...	$1\frac{1}{2}$	,,	$3\frac{2}{3}$	,,	,,	13	6	,,	$1\frac{1}{2}$
,, ...	2	,,	8	,,	,,	12	0	,,	$1\frac{1}{4}$
,, ...	$2\frac{1}{2}$	,,	12	,,	,,	11	0	,,	$1\frac{1}{4}$
,, ...	3	,,	20	,,	,,	10	6	,,	1
,, ...	$3\frac{1}{2}$	,,	25	,,	,,	10	6	,,	1
,, ...	4	,,	40	,,	,,	10	6	,,	1
,, ...	$4\frac{1}{2}$	,,	50	,,	,,	10	6	,,	1
,, ...	5	,,	67	,,	,,	10	6	,,	1
Wrought brads	$\frac{1}{2}$	,,	$\frac{1}{2}$	,,	,,	50	0	,,	$5\frac{1}{4}$

NAILS, STEEL—*continued.*

			Per 1,000.		Per Cwt. *s.*	*d.*		Per Lb. *d.*
Wrought brads	$\frac{3}{4}$	in. weigh	$\frac{3}{4}$	lb. and cost	35	0	or	$3\frac{3}{4}$
,, ,, ...	1	,,	1	,, ,,	30	0	,,	$3\frac{1}{4}$
,, ,, ...	$1\frac{1}{4}$	,,	2	,, ,,	27	0	,,	3
,, ,, ...	$1\frac{1}{2}$	,,	3	,, ,,	25	0	,,	$2\frac{3}{4}$
,, ,, ...	2	,,	5	,, ,,	22	6	,,	$2\frac{1}{2}$
,, ,, ...	$2\frac{1}{4}$	,,	$10\frac{1}{2}$	,, ,,	19	0	,,	2
,, ,, ...	$2\frac{1}{2}$	,,	$15\frac{1}{2}$	,, ,,	17	6	,,	2
,, ,, ...	3	,,	18	,, ,,	16	0	,,	$1\frac{3}{4}$

Wire nails, chequered head (mixed), cost 9*s.* per cwt., or 1*d.* per lb.

Screws. — Nettlefold's patent screws are now almost wholly employed, and are frequently termed "fine," "middling," or "strong"; but it is better to state the gauge as well as the length. This gauge, or diameter, is indicated by the number in describing the screw, and increases with that number. The following are the trade rules for the measurement of all screws :—

(1) All countersunk screws are measured overall.

(2) All raised head screws are measured to the top of countersink.

(3) All round, cone, square, hexagon, and cheese head screws are measured from the underside of head.

A list with fixed prices is published by the screw merchants, off which there is a discount of 60 per cent. for iron, and 50 per cent. for brass. Nettlefold's list is the one almost universally employed. Screws are mostly used by the joiner, and are often called "wood screws," possibly to distinguish them from those of a different make used for metal. Allow 5 per cent. for waste in fixing, as for nails. Their lengths are likewise determined by taking about twice the thickness of wood to be fixed. For hardwoods brass screws would be used, and of a somewhat lighter gauge than for deal.

For driving screws allow 10 minutes, or one-sixth hour joiner at $10\frac{1}{2}d.$, per inch per dozen, $=1\frac{3}{4}d.$ Double this amount for hardwood.

ITEMS OF WORK.

Only the principal items have been analysed; others can be worked from these as a guide, the labour being obtained from the tables of constants.

TIMBER FIXED, BUT NOT FRAMED.

Fir, rough, in Plates, &c.—As this would probably be cut partly out of balk and partly out of deal timber, it would be

best to adopt 2*s.* as the price per foot cube, supplied only. But the estimator can start with 2*s.* 10*d.* or 1*s.* 7*d.*, according to his judgment. Allow half an hour for labour in preparing and fixing, as the bedding is included in bricklayer's work.

	s.	*d.*
1 ft. cube of fir, rough, delivered on site	2	0
Nails, cut clasp, say	0	0¼
Fixing, ½ hour carpenter at 10½*d.*	0	5¼
	2	5½
Add 15 per cent. profit	0	4½
Price per foot cube	2	10

Fir wrought, ditto.—To the foregoing it would only be necessary to add the cost of planing, which would be four sides, or 4 ft. super., as the ends of these scantlings would not be taken into account. As carpenter's work is invariably hand-planed, the rate would be 1*d.* per foot super.

	s.	*d.*
1 ft. cube rough fir, delivered on site	2	0
Nails, cut clasp, say	0	0¼
Planing, 4 ft. super. at 1*d.*	0	4
Fixing, ½ hour carpenter at 10½*d.*	0	5¼
	2	9½
Add 15 per cent. profit	0	5½
Price per foot cube	3	3

Timber Framed and Fixed.

Fir, rough, in Roof Trusses, &c.—This would be analysed as previous examples, only the scantlings would probably be cut out of balk timber, and the initial price for the wood would be taken as 2*s.* 10*d.* per foot cube. No nails are necessary. The labour here is one hour carpenter.

	s.	*d.*
1 ft. cube of rough fir, delivered on site	2	10
Framing and fixing, 1 hour carpenter at 10½*d.*	0	10½
	3	8½
Add 15 per cent. profit	0	6½
Price per foot cube	4	3

A carpenter will fix 20 purlin cleats, 12 in. by 5 in. by 4 in., per hour on roof.

Fir, wrought, ditto.—In roofs and trusses there will be double the proportion of planing assumed in wrought plates, joists, &c., and this is generally reckoned at 8 ft. super. per cubic foot of fir, owing to the large quantity of wrought face compared with the cubic contents of timber.

	s.	*d.*
1 ft. cube of rough fir, as before	2	10
Planing, 8 ft. super. at 1*d.*	0	8
Framing and fixing, 1 hour carpenter at 10½*d.*	0	10½
	4	4½
Add 15 per cent. profit	0	7½
Price per foot cube	5	0

Hoisting Trusses.—For hoisting trusses a handy calculation is to multiply the two dimensions together and divide by 10, the quotient to be taken as pence. Thus to raise a truss 20 ft. span, 30 ft. high—

$$20 \times 30 = 600 \div 10 = 60d., \text{ or } 5s.$$

Proper Fir Door-Frames, wrought, framed, chamfered, or beaded, and fixed.—These would be similarly worked out. The following constants of labour will be useful in this respect:—

		Hours of a Carpenter.
Wrought, rebated, and beaded or chamfered door-frames, labour, making, and fixing	per ft. cube	3·00
Double-rebated transoms ditto, ditto	,,	3·30
Fir wrought and framed	,,	2·00
,, ,, and rebated	,,	2·60

	s.	*d.*
1 ft. cube of fir, rough, delivered	2	0
Labour complete, 3 hours carpenter at 10½*d.*	2	7½
	4	7½
Add 15 per cent. profit	0	8½
Price per foot cube	5	4

Segmental heads to door-frames are worth twice straight.

Semi-circular heads to door-frames are worth 2½ times straight.

Transoms, being in shorter lengths, are worth 10 per cent. more than frames.

Pile-Driving.

The following has been given in a paper contributed to the Institution of Junior Engineers by Mr. H. C. Reid, M.I.C.E.,

Admiralty Works Department:—The cost of piles and pile-driving varies very considerably; but under favourable circumstances the statement below may be taken as approximately the analysis of the cost of a 12 in. by 12 in. pile, 40 ft. long, driven 30 ft. into the ground.

	£	s.	d.
40 ft. cube pitch pine at 1s. 9*d*.	3	10	0
One cast-iron shoe and straps	0	3	0
Use of ring per pile...	0	0	6
Labour in ringing and shoeing	0	3	0
Pitching pile, including one move of pile engine	0	2	6
30 ft. run driving in medium soil at 8*d*.	1	0	0
Cutting off head on shore...	0	1	0
Total per pile	5	0	0

Battens and Fillets.

These may be conveniently taken together. As stated under Tiler, battens or laths are imported ready sawn in various sizes, and may be bought, usually in 10 ft. lengths, at the sawmills at the following prices:—

Measurement.	in. in. $2 \times \frac{3}{4}$	in. in. $1\frac{1}{4} \times 1$	in. in. $1\frac{1}{4} \times \frac{3}{4}$	in. in. $1 \times \frac{3}{4}$
	s. *d*.	*s*. *d*.	*s*. *d*.	*s*. *d*.
Price per 100 ft. run..................	1 6	0 9	0 8	0 7
,, 1 ft. ,, ...	0 $0\frac{1}{4}$	0 $0\frac{1}{8}$	0 $0\frac{1}{8}$	0 $0\frac{1}{16}$

The prices of fillets are found from deals according to the cost per standard. As there are 165 ft. cube and 1,980 ft. super. at 1 in. thick in a St. Petersburg standard, the prices of the various sizes of fillets can thus be arrived at, including sawing and 5 per cent. for waste and breakage. Greenwood's "Timber Calculator" explains, among other useful things, the "inch by inch" method of measuring timber, which is based upon the principle of reckoning that whatever the value of the timber is per standard in *pounds* sterling, it will be the same value in *pence* of per 100 ft. lineal of 1 in. by 1 in. For example, £11 per standard is 11*d*. per 100 ft. run of 1 in. by 1 in., and £8 10*s*. per standard is $8\frac{1}{2}$*d*. per 100 ft. run of 1 in. by 1 in.

Further example.—Supposing it is required to find out the price of $3\frac{1}{2}$ in. by 2 in. filleting when deals are £10 10*s*. per

standard. This is equivalent to 10½*d.* per 100 ft. run of 1 in by 1 in. fillets by foregoing rule. And 3½ in. by 2 in. = 7 sq. in., so that 7 sq. in. × 10½*d.* = 73½*d.*, or 6*s.* 1½*d.* per 100 ft. run of 3½ in. by 2 in. fillet. It will thus be seen that this method is invaluable for small scantling.

Another rule worth remembering is that the price of timber in scantlings at 3*s.* per cubic foot is equal per foot run to one farthing per square inch of sectional area. Thus, take the following scantlings :—

3 in. × 2 in. = 6 sq. in. at ¼*d.* = 1½*d.* per foot run.
4 in. × 3 in. = 12 sq. in. ,, = 3*d.* ,,
5 in. × 4 in. = 20 sq. in. ,, = 5*d.* ,,

The following table, also from Greenwood's "Calculator," will be convenient for telling at a glance the cost of such small-sized timber at a given rate per St. Petersburg standard. It dispenses with the immense labour in dividing, subtracting, supering, and cubing when pricing out each size in accounts or in estimating. A fresh table is required with every difference in rate per standard, except when multiples can be employed. Such useful tables are called the "equation of deals." The deals are at, say £12 7*s.* 6*d.* per St. Petersburg standard = 1*s.* 6*d.* per foot cube (£12 7*s.* 6*d.* ÷ 165) = 1½*d.* per foot super. at 1 in. thick (£12 7*s.* 6*d.* ÷ 1,980). The table shows cost per foot run, supplied only.

SCANTLINGS AT £12 7*s.* 6*d.* PER STANDARD.

Inches in width.	Inches in thickness. Cost per foot run.										
	4	3½	3	2½	2	1¾	1½	1¼	1	¾	½
	d.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*
12	6	5¼	4½	3¾	3	2⅝	2¼	1⅞	1½	1⅛	¾
11	5½	4¾	4⅛	3⅜	2¾	2⅜	2	1⅝	1⅜	1	⅝
10	5	4⅜	3¾	3⅛	2½	2⅛	1⅞	1½	1¼	⅞	⅝
9	4½	3⅞	3⅜	2¾	2¼	1⅞	1⅝	1⅜	1⅛	¾	½
8	4	3½	3	2½	2	1¾	1½	1¼	1	¾	½
7	3½	3	2⅝	2⅛	1¾	1½	1¼	1	⅞	⅝	⅜
6	3	2⅝	2¼	1⅞	1½	1¼	1⅛	⅞	¾	½	⅜
5	2½	2⅛	1⅞	1½	1¼	1	⅞	¾	⅝	½	¼
4	2	1¾	1½	1¼	1	⅞	¾	⅝	½	⅜	¼
3	1½	1¼	1⅛	⅞	¾	⅝	½	⅜	⅜	¼	¼
2	1	⅞	¾	⅝	½	⅜	⅜	¼	¼	⅛	⅛
1	½	½	⅜	⅜	¼	¼	¼	⅛	⅛	⅛	1/16

The constants of labour for foregoing will be:—

		Hours of a Carpenter.
Battening, including plugging to wall, $\frac{3}{4}$ in. to $1\frac{1}{4}$ in., at 12 in. centres	per square	2·60
Fixing only battens to Countess slating	,,	2·00
,, eaves fillet	per ft. run	·06
,, rough fillet	,,	·03

As an example of analysis take such an item as 3 *in. by* $1\frac{1}{2}$ *in. rough fillet, and fixed:—*

	s.	d.
1 ft. run of 3 in. by $1\frac{1}{2}$ in. rough fillet, as per table	0	$0\frac{1}{2}$
Two nails, per ft. run...	0	$0\frac{1}{8}$
Labour, ·03 hour carpenter at $10\frac{1}{2}d.$	0	$0\frac{1}{4}$
	0	$0\frac{7}{8}$
Add profit	0	$0\frac{1}{8}$
Price per foot run	0	1

Battening for Slates.

Deal Battening, 2 in. by $\frac{3}{4}$ in. Spaced for Countess Slating and Fixed with Iron Nails.—As already shown, battens of this size cost 1*s.* 6*d.* per 100 ft. run, and would be spaced apart, centre to centre, at the same gauge as the slates—that is, at $8\frac{1}{2}$ in., adopting the usual gauge for Countess slating laid to 3 in. lap, and nailed in centre. A square being 10 ft., or 120 in., each way, there would be 120 in. ÷ $8\frac{1}{2}$ in. = 14 rows of battens, each 10 ft. long = 140 ft. of battening per square. Reckon one nail, $1\frac{1}{2}$ in. long, per foot run of batten, as the rafters being spaced at 12 in. would take the point of the nail, whether there was roof boarding or not. Allow 5 per cent. waste in battens and nails, and put down two hours carpenter for nailing. The detailed sum would then appear:—

	s.	d.
140 ft. run of 2 in. by $\frac{3}{4}$ in. battens at 1s. 6*d.* per 100 ft. run ...	2	1
10 per cent. waste on ditto	0	$2\frac{1}{2}$
Cartage, unloading, and hoisting to roof	0	6
140 nails + 5 per cent. waste = 150 nails, $1\frac{1}{2}$ in. = $\frac{1}{2}$ lb. at $1\frac{1}{2}d.$	0	$0\frac{3}{4}$
2 hours carpenter fixing at $10\frac{1}{2}d.$	1	9
	4	$7\frac{1}{4}$
Add 15 per cent. profit	0	$8\frac{3}{4}$
Price per square	5	4

Bracketing.

One-inch Deal Bracketing to Cornices.—This is a support for the laths and plastering in running a cornice, and the profile

of the bracket roughly approximates to that of the cornice. Fig. 35 is a sketch of ordinary bracketing, which is supported by the two fillets shown; but these are taken separately. A bracket of the shape given would measure 18 in. by 16 in.,

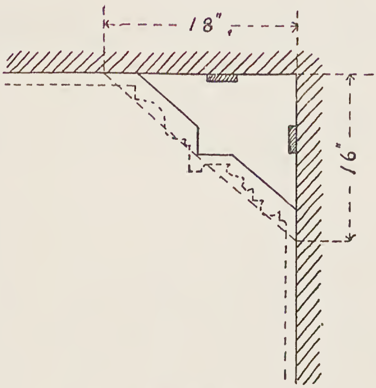

Fig. 35.

extreme dimensions, and two brackets would be cut out of a rectangular board with these sides.

The bracketing is measured by taking the length of the cornice by the girth of the moulding, making a superficial dimension; but there would be one bracket to each foot run. Sawing must be allowed for the irregular shape and for the notches to receive the fillets. Add nails and labour.

		s.	d.
½/1 . 6			
1 . 4			
—— 1 . 0	ft. super. 1 in. rough deal	0	1
	Sawing to shape...	0	0½
	Cartage and waste	0	0¼
	Nails, say	0	0¼
	Fixing, ¼ hour carpenter at 10½*d.*	0	2½
		0	4½
	Add profit	0	0½
	Price per foot super.	0	5

Angle-brackets would require about the same material; but there would be twice as much labour, as there is a bevel

on each edge to receive the laths at either side. So the total comes to 8*d.*

MACHINE-PREPARED BOARDINGS.

One-inch Rough Deal Roof Boarding, in Batten Widths, and Fixed Complete.—Rough boarding, $\frac{3}{4}$ in., 1 in., and $1\frac{1}{4}$ in. thick, is imported ready sawn from the Baltic; and if over this thickness, has to be cut out of deals or battens. The prices at the docks are:—

		s.	*d.*
$\frac{3}{4}$-in. rough boarding, batten widths	per square	11	0
1-in. ,, ,, ,, ,, ...	,,	13	0
$1\frac{1}{4}$-in. ,, ,, ,, ,, ...	,,	15	0

To the above add 3*s.* 9*d.* for landing rate and 13*s.* for cartage per St. Petersburg standard, equivalent to 1,980 ft. super. of 1-in. boarding. Add unloading on site, and 10 per cent. waste. As the battens are 7 in. wide, this would give 17 boards, each 10 ft. long, per square; and, as there are two nails where each board crosses each rafter 12 in. apart, 340 nails plus 5 per cent. waste equals 357, or 3 lb. total of 2-in. nails required to the square. Labour laying, $3\frac{1}{3}$ hours of carpenter.

	s.	*d.*
1-in. rough boarding, cost per square at docks	13	0
Waste, 10 per cent.	1	4
Landing rate, $\frac{100}{1980}$, or, say $\frac{1}{20}$th standard at 3*s.* 9*d.*	0	$2\frac{1}{4}$
Cartage ditto at 13*s.*	0	8
Unloading, $\frac{1}{4}$ hour labourer at 7*d.*	0	$1\frac{3}{4}$
Hoisting to roof, $\frac{1}{4}$ hour labourer at 7*d.*	0	$1\frac{3}{4}$
2-in. nails, 3 lb. at $1\frac{1}{4}d.$	0	$3\frac{3}{4}$
Labour laying, $3\frac{1}{3}$ hours carpenter at $10\frac{1}{2}d.$	2	11
	18	$8\frac{1}{2}$
Add 15 per cent. profit	2	$9\frac{1}{2}$
Total price per square	21	6

One-inch Rough Deal Boarding traversed for Lead or Zinc and Firring to Falls.—This would be detailed in a similar manner to the foregoing, with the additional labour for traversing and the cost and fixing of the firrings. The latter would be an average size of 2 in. by $1\frac{1}{2}$ in., taking a fall of $1\frac{1}{2}$ in. in 10 ft., and the price of $\frac{3}{8}d.$ per foot run from the table of Fillets given on p. 200.

Allow, with waste, 100 ft. run per square, and 3 lb. of $2\frac{1}{2}$ in. nails. For labour in cutting, fitting, and fixing the

firrings take 2 hours carpenter. The whole cost per square would thus appear :—

	s.	d.
1-in. rough boarding, cost per square at docks	13	0
Waste, 10 per cent.	1	4
Landing rate, $\frac{1}{20}$ standard at 3*s.* 9*d.*	0	$2\frac{1}{4}$
Cartage ditto at 13*s.*	0	8
Unloading, $\frac{1}{4}$ hour labourer at 7*d.*	0	$1\frac{3}{4}$
Hoisting to roof	0	$1\frac{3}{4}$
2-in. nails, 3 lb. at $1\frac{1}{4}$*d.*	0	$3\frac{3}{4}$
Labour laying, $3\frac{1}{3}$ hours carpenter at $10\frac{1}{2}$*d.*	2	11
Traversing, 1 hour carpenter at $10\frac{1}{2}$*d.*	0	$10\frac{1}{2}$
Firrings, 100 ft. run, 2 in. by $1\frac{1}{2}$ in., at $\frac{3}{8}$*d.*	3	$1\frac{1}{2}$
$2\frac{1}{2}$-in. nails, 3 lb. at $1\frac{1}{4}$*d.*	0	$3\frac{3}{4}$
Labour, 2 hours carpenter at $10\frac{1}{2}$*d.*	1	9
	24	$9\frac{1}{4}$
Add 15 per cent. profit	3	$8\frac{3}{4}$
Total price per square	28	6

For machine prepared Matchboardings it is only necessary to add to the foregoing calculations extra labour for more careful nailing and the cost of the sawmill charges as given on p. 227. For example, for 1-in. V-jointed matchboarding, prepared one side, and fixed :—

	s.	d.
1-in. rough deal boarding, fixed, as before...	18	$8\frac{1}{2}$
Sawmill charge for preparing, as p. 227	3	9
Extra labour, 3 hours carpenter at $10\frac{1}{2}$*d.*	2	$7\frac{1}{2}$
	25	1
Add 15 per cent. profit	3	9
Total price per square	28	10

Yellow deal matchboarding, however, is imported all ready prepared in batten widths, and if this be used its cost is totalled up just like rough boarding. The prices at the docks are :—

	Firsts.		Seconds.		Thirds.	
	s.	d.	s.	d.	s.	d.
$\frac{5}{8}$-in. yellow deal matching, per square ...	12	0	10	6	9	0
$\frac{3}{4}$-in. ,, ,, ,, ,, ...	14	6	13	0	11	

Deal Boarding.

This is calculated from the cost of boarding per square as already analysed, and reduced to the foot super. As it is intended to be used in small quantities, more nails and

labour will be required, and there will be also an addition for further sawing and waste.

		s.	d.
1-in. rough boarding, fixed, as before ...	per square 100)	18	8½
		0	2¼
Extra nails and labour		0	0½
Further sawing and waste		0	0¼
		0	3
Add profit		0	0½
Price per foot super.		0	3½

Other thicknesses and kinds of boarding can be similarly dealt with.

One-inch Gutter Boards and Bearers.—Allow about one-fifth extra for waste in cutting and raking, as the gutters taper on plan owing to the rise. The boards and bearers are of the roughest description, and the latter are taken as fixed, not framed.

	s.	d.
1 ft. super. of 1-in. rough boarding at 13*s*. per square	0	1½
Waste 10 per cent. plus ⅕th extra	0	0¼
Bearers, 3 in. by 2 in., 2 ft. at ⅝*d*.	0	1½
Nails	0	0¼
Labour, ¼ hour carpenter at 10½*d*.	0	2½
	0	6
Add profit	0	1
Price per foot super.	0	7

Centrings and Casings.

Use of 1 *in. Flat Centring to Concrete Floors, including Supports.*—Most of the material used for this is old stuff, and can be utilised again. Rough sills and heads, with supporting struts, are required at about every 5 ft. apart, and for all these 9 in. by 3 in. planks can be employed. If the story is 14 ft. high, then allow about 130 ft. run of this planking. A labourer will be required to assist the carpenter in fixing and removing.

	s.	d.
1-in. rough boarding, per square at docks	13	0
130 ft. run of 9 in. by 3 in. planking at 3⅜*d*.	36	6½
Landing rate, ⅕th standard at 3*s*. 9*d*.	0	9
Cartage, " " at 13*s*.	2	7
Unloading, ½ hour labourer at 7*d*.	0	3½
Initial cost of material per square	53	2

Then proceed to use and waste, fixing and removing:—

	s.	d.
Use and waste of material, 10 per cent. on 53*s.* 2*d.*	5	4
3-in. nails, ½ lb. at 1*d.*, for fixing supports...	0	0½
6 hours carpenter at 10½*d.*	5	3
6 hours labourer at 7*d.*	3	6
	14	1½
Add 15 per cent. profit	2	1½
Price per square	16	3

Turning Pieces for 4½-in. Soffit and Fixing.—These are single slips of deal cambered on top edge, and without lagging pieces.

	s.	d.
1 ft. run of rough deal fillet	0	1½
Labour, $\frac{1}{10}$ hour carpenter at 10½*d.*...	0	1
	0	2½
Add profit	0	0½
Price per foot run	0	3

Doors.

Before proceeding to analyse the cost of doors it will be well to know the following labours:—

		Hours of a Carpenter.		
Making doors, deal—		1¼ in.	1½ in.	2 in.
Ledged, rough, and edges shot	per ft. sup.	·22	·25	—
Ditto, add if ploughed and tongued ...	,,	·47	·51	—
,, ditto wrought B.S.	,,	·32	·42	—
,, ,, braced	,,	·05	·06	—
,, ,, if hung in one leaf	,,	·14	·16	—
Square framed, two panels	,,	·36	·36	·42
,, four ,, ...	,,	·42	·42	·48
,, six ,, ...	,,	·48	·48	·53
,, add to each face if moulded	,,	·11	·11	·11
,, if hung folding	,,	·15	·15	·15
Hanging doors	,,	·08	·08	·10
Ditto folding	,,	·16	·16	·20
Door linings—				
Square, planed, fixed complete, including		¾ in.	1 in.	1¼ in.
backings	,,	·18	·20	·23
Single rebated, ditto	,,	—	·28	·30
Double rebated ,, ...	,,	—	·36	·38

A common price for hanging a door is 1*s.* 6*d.* in speculating work. The men will hang them (piecework) at 1*s.* each. A carpenter will hang about six ordinary four-panel doors per day, or one door in 1⅔ hours, which runs to about ¾*d.* per

foot super. In preparing and hanging doors and gates, the time of a labourer should be added for every two carpenters. In all cases the fixing of doors involves and includes the fixing of the hinges.

A joiner will make a $1\frac{1}{2}$-in. framed four-panel door in

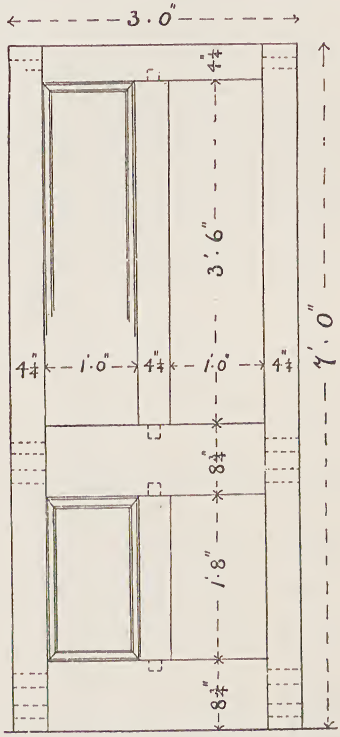

FIG. 36.

about a day, or say nine hours; a 2-in. framed ledged door in fourteen hours, and two ledged trap doors in a day.

Doors with semi-circular heads are worth 50 per cent. more than square; doors with segmental heads are worth 25 per cent. more than square; trap and dwarf doors are worth 25 per cent. more than ordinary; doors prepared for glass are worth 1*d.* per foot super. more than ordinary.

For finished sizes add 1*d.* per foot super. to the value of framings. Partitions of spandrel shape are worth about 20 per cent. more than rectangular ones.

To arrive at a price per foot super. the cost of a whole door must be worked out in detail, and the result divided by the area in square feet will yield the rate per foot super. Take a $1\frac{1}{2}$-*in. Deal Door, four-panel, square framed, and moulded both sides, and Hung.* Fig. 36 will clearly indicate the dimensions and construction. As the framing is supposed to be cut out of deals and half-deals, an allowance of $\frac{1}{8}$ in. each side has in this case been made for finished sizes, so that 9 in. and $4\frac{1}{2}$ in. are taken up in the quantities. Panels are $\frac{3}{4}$ in. thick, and $\frac{1}{2}$ in. extra must be allowed in length and breadth for insertion in the grooves along the inside of the framing. In measuring the latter, the tenons and horns must not be forgotten. The moulding is planted on, and would be machine made. The door being 7 ft. by 3 ft., contains 21 ft. super., and its price per foot super. would be arrived at in the following fashion :—

Top rail	3 . 0
Stile	7 . 0
,, ...	7 . 0
Munting	3 . 6
,, ...	1 . 8
Tenons, 4/2 in.	. 8
	22 . 10

			s.	d.
22 . 10 . $4\frac{1}{2}$	8 . 7	Top rail, stiles, and munting.		
2/3 . 0 . 9	4 . 6	Middle and bottom rails.		
	13 . 1	ft. super. of $1\frac{1}{2}$-in. wrot. B.S. deal, S.O., at 4*d.*	4	4
2/3 . 7 1 . 1	7 . 9	Top panels.		
2/1 . 9 1 . 1	3 . 10	Bottom ditto.		
	11 . 7	ft. super. of $\frac{3}{4}$-in. wrot. B.S. deal, S.O., at $2\frac{1}{2}$*d.*	2	5
2/4/3 . 6	28 . 0			
2/4/1 . 8	13 . 4			
2/8/1 . 0	16 . 0			
	57 . 4	ft. run of moulding, B.S., at $\frac{3}{4}$*d.*	3	7
Mitres, and fixing moulding, say 58 ft. run, at $\frac{1}{4}$*d.*			1	$2\frac{1}{2}$
Glue, $\frac{1}{2}$ lb. at 9*d.*, and wedges			0	$4\frac{1}{2}$
Glass paper, four sheets at $\frac{1}{2}$*d.*			0	2
Labour making door, 9 hours joiner at $10\frac{1}{2}$*d.*			7	$10\frac{1}{2}$
Carried forward			19	$11\frac{1}{2}$

	s.	d.
Brought forward	19	11½
Labour hanging door, 1⅔ hours joiner at 10½*d.*	1	5½
	21	5
Add 15 per cent. profit	3	2
Price per door (21 F.S.)	21)24	7
Price per ft. super	1	2

The labour in making the door thus works out to 4½*d.* per foot super., and ¾*d.* per foot super. for the hanging.

All other framed doors are dealt with in a similar manner, the cost of the hinges and locks being taken in the *Ironmonger*. For ledged doors take the case following.

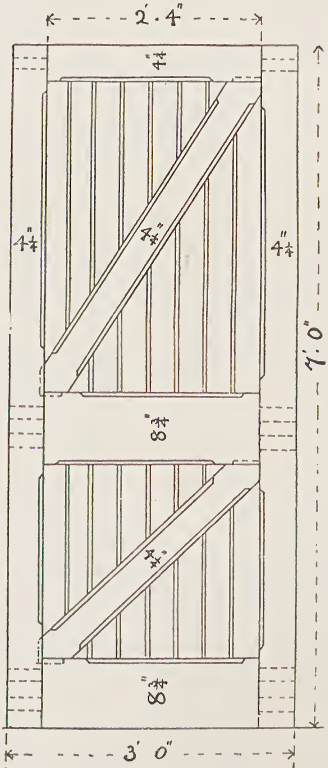

FIG. 37.

2-in. Deal Framed and Braced Door, filled in with Ploughed and Tongued V-chamfered Matchboarding, and Hung.—For convenience of analysis, the same sizes have been adhered to as shown in the framed door, and the same allowances made for finished work. The braces and middle and bottom rails are less the thickness of the 2-in. framing by the thickness of the ½-in. matchboarding, so that they measure only 1½ in. thick.

Top rail ...	3 . 0
Stile ...	7 . 0
„ ...	7 . 0
	17

			s.	d.
17 . 0 0 . 4½	6 . 4	Ft. super. wrot. B.S. deal, s.o., at 5*d*. ...	2	8
7 . 8 0 . 4½	2 . 10	Braces.		
2/3 . 0 0 . 9	4 . 6	Middle and bottom rails.		
	7 . 4	Ft. super, 1½-in. wrot. B.S. deal, s.o., at 4*d*. ...	2	5
6 . 8 2 . 4	15 . 7	Ft. super. ½-in. matchboarding, at 2*d*. ...	2	7
28 ft. run chamfering to framing at ¼*d*. ...			0	7
24 stops to ditto at ½*d*. ...			1	0
Glue, town-made, ½ lb. at 9*d*., and wedges...			0	4½
Glass paper, four sheets at ½*d*. ...			0	2
Nails, ¾ lb. at 1¼*d*. ...			0	1
Labour making door, 14 hrs. joiner at 10½*d*. ...			12	3
Labour hanging door, 1¾ hrs. joiner at 10½*d*. ...			1	6½
			23	8
Add 15 per cent. profit ...			3	7
		Price per door (21 F.S.) ...	21)27	3
		Price per foot super. ...	1	3½

The labour in making is therefore 7*d*. per foot super., and ¾*d*. per foot super. for the hanging.

Doors, door casings, door frames, &c., are supplied by joinery manufacturers, ready made complete, at extremely low rates, and considerably under the preceding.

Floors.

Before analysing cost, the following memoranda ought to be studied.

One square of flooring requires—

		No.	ft. in.
For floors, rough	... ...	12 boards	12 by 9 (deals)
,, ,, edges shot...	... ...	12½ ,,	,, ,,
,, wrought and laid folding	...	13 ,,	,, ,,
,, ,, straight joint	... ...	13½ ,,	,, ,,
,, ,, ploughed and tongued	...	14 ,,	,, ,,
,, rough	... ...	16 ,,	12 by 7 (battens)
,, ,, edges shot...	... ...	16½ ,,	,, ,,
,, wrought and laid folding	...	17 ,,	,, ,,
,, ,, straight joint	... ...	18 ,,	,, ,,
,, ,, ploughed and tongued	...	18 ,,	,, ,,

Prepared flooring-boards are sold by the "customary square," which is a given number of feet run, as stated below, varying with the width of the board, but always so arranged as to approximate to the ordinary square of 100 ft. super.

				Feet super.	
140 ft. run	of 9-in.	boards	(deals)	= 105	customary square.
160 ,,	8	,,	,,	= 106⅔	,, ,,
170 ,,	7½	,,	,,	= 106¼	,, ,,
180 ,,	7	,,	(battens)	= 105	,, ,,
185 ,,	6¾	,,	,,	= 104 1/12	,, ,,
190 ,,	6½	,,	,,	= 102 11/12	,, ,,
200 ,,	6	,,	,,	= 100	,, ,,
210 ,,	5¾	,,	,,	= 100⅔	,, ,,
220 ,,	5½	,,	,,	= 100 10/12	,, ,,
230 ,,	5¼	,,	,,	= 100⅔	,, ,,
240 ,,	5	,,	,,	= 100	,, ,,
270 ,,	4½	,,	,,	= 101¼	,, ,,
300 ,,	4	,,	,,	= 100	,, ,,

To save calculations, tables showing cubical measure, number of St. Petersburg standards, valuations, &c., will be found in Laxton's and Lockwood's price-books.

Nails Required for Flooring.

Thickness of Floor.	Length.	Weight per Thousand.		Number per Square.		
		Wrot.	Cut Clasp.	Deal Widths.	Batten Widths.	4½-in. Widths.
in.	in.	lb.	lb.			
¾	2	8	8	260; or 270, allowing 5 per cent. for waste.	340; or 360, allowing 5 per cent. for waste.	520; or 550, allowing 5 per cent. for waste.
1	2½	12	12			
1	2¾	16	15			
1½	3¼	25	20			
1¾	3½	32	25			
2	4	40	35			

The nails used for deal widths should be about one-fifth heavier than those for floors laid in batten widths. The number is calculated for two nails where each board crosses every joist, spaced at 12 in. centre to centre.

Flooring Labours.

		Hours of a Carpenter.
Floors laid and cleaned off only, batten widths, straight joint, with splayed headings, 1 in. ...	per square	4·00
Ditto, $1\frac{1}{4}$ in.	,,	4·50
,, $1\frac{1}{2}$ in.	,,	4·85
,, 2 in.	,,	5·50
,, but tongued and grooved, or rebated, 1 in....	,,	5·35
,, ,, ,, ,, $1\frac{1}{4}$ in....	,,	5·90
,, ,, ,, ,, $1\frac{1}{2}$ in....	,,	6·45
,, ,, ,, ,, 2 in....	,,	6·75
Add to foregoing if punched, puttied, and traversed	,,	2·50

Yellow deal for flooring must not be confused with yellow pine. The former is the wood of the Scotch fir (*Pinus sylvestris*), and is otherwise called "red deal," or "red fir." That used in England comes almost entirely from the Baltic—from Memel, Dantzic, and Stettin. Yellow pine, otherwise called Weymouth pine, is the wood of the American *Pinus strobus*, and that shipped from Quebec has the best reputation.

The following prices are for yellow deal prepared flooring, tongued and grooved, or square edge:—

		Firsts. *s.* *d.*	Seconds. *s.* *d.*	Thirds. *s.* *d.*
1 in. by 6 in. or 7 in.	per square	14 0 ...	12 6 ...	11 0
$1\frac{1}{4}$ in. by 6 in. or 7 in.	,,	18 0 ...	16 0 ...	14 0

Proceeding now to the analysis of an example of flooring: *$1\frac{1}{4}$-in. Yellow Deal Wrought Batten Floor, Ploughed and Tongued, Splayed Headings, Punched and Puttied.*

	s.	*d.*
$1\frac{1}{4}$-in. yellow deal flooring, seconds, cost per customary square at docks	16	0
Waste in conversion, 10 per cent.	1	7
Landing rate, $\frac{100}{1584}$, or say $\frac{1}{16}$th standard at 3*s.* 9*d.*	0	$2\frac{3}{4}$
Cartage ,, ,, ,, 13*s.*	0	10
Unloading, $\frac{1}{4}$ hour labourer at 7*d.*	0	$1\frac{3}{4}$
$2\frac{3}{4}$-in. nails, $\frac{360}{1000} \times 15$ lb. $= 5\frac{1}{3}$ lb. cut clasp at $1\frac{1}{4}$*d.*	0	$6\frac{3}{4}$
Labour laying and cleaning off, 6 hours carpenter at $10\frac{1}{2}$*d.* ...	5	3
Labour punching and puttying, 2 hours carpenter at $10\frac{1}{2}$*d.* ...	1	9
	26	$4\frac{1}{4}$
Add 15 per cent. profit	4	$1\frac{3}{4}$
Total price per square	30	6

¾-in. Sound Boarding, including Deal Fillets.—There will be considerable waste here in sawing the boards to fit in between the joists, but this will be covered if the measurement does not deduct the latter. The prices of the boarding and fillets have already been individually given, but for these almost any old material is used. As there would be a fillet nailed to either side of each joist, 200 ft. run of filleting would be required per square.

	s.	*d.*
¾-in. rough boarding per square at docks	11	0
Landing rate, $\frac{100}{2640}$ or $\frac{1}{26}$ standard at 3*s.* 9*d.*	0	1¾
Cartage " " " 13*s.*	0	6
Unloading, as before	0	1½
200 ft. run or 1¼-in. by 1-in. fillet at ⅛*d.*	2	1
2 lb. nails at 1¼*d.*	0	2½
Fixing boarding and fillets, 8 hrs. carpenter at 10½*d.*	7	0
	21	0¾
Add 15 per cent. profit	3	1¼
Total price per square	24	2

2-*in. by* 1½-*in. Herring-bone Strutting to* 11-*in. Joists, and firmly Nailed.*—Joists of this depth and 12 in. apart would have two fillets, each 1 ft. 2 in., measured sloping, or a total of 2 ft. 4 in. per foot run, taken horizontally across the top of the joists. The custom of measuring the joists in only partially counterbalances the waste in cross-cutting the fillets.

	s.	*d.*
2 ft. 4 in. of 2-in. by 1½-in. rough fillet at ⅜*d.*	0	1
Cartage, and extra waste in cutting	0	0½
Nails, say	0	0¼
Labour cutting four splayed ends to fit joists at ¼*d.*	0	1
Labour fixing, ⅛th hour carpenter at 10½*d.*	0	1¼
	0	4
Add profit	0	0½
Price per foot run	0	4½

Rolls.

2-*in. Deal Roll for Lead and Fixed.*—Deal rolls are generally rounded by machinery, and are bought ready for fixing at the sawmills. The detailed calculation is simple.

	s.	*d.*
1 ft. run of 2-in. roll at sawmills	0	1¼
Waste cutting to lengths, and nails	0	0½
Labour nailing	0	0½
	0	2¼
Add profit	0	0¼
Price per foot run	0	2½

For birdsmouthed roll add $\frac{1}{4}d.$ per foot for the labour to birdsmouth on underside, or $2\frac{3}{4}d.$ per foot run in all.

Mitres to Ditto.—Allow the value of one foot run of roll these; say $2\frac{1}{2}d.$ each.

Casements, Sashes, and Sash-frames.

Constants of Labour.		Hours of a Carpenter.
Labour from bench, 1½-in. ovolo moulded casement, single squares	per ft. sup.	·32
Ditto, ditto, add for small squares	,,	·32
Ditto, 2-in. ditto, single squares	,,	·37
Ditto, ,, add for small squares	,,	·37
Hanging casements, 1½ in. or 2 in.	,,	·16

The words "from bench" means that fixing or hanging is not included in the constant. Take curved heads as twice that of straight. Circular on plan ditto.

		Hours of a Carpenter.
1½-in. deal moulded or bevel bar sashes, made and fixed complete	per ft. sup.	·45
2-in. ditto, ditto	,,	·60
Labour from bench, deal-cased frames with oak sunk sills, and 1½-in. sashes, single hung	,,	·66
Ditto, ditto, double ditto...	,,	·78
Ditto, ditto, 2-in. sashes, single ditto	,,	·78
Ditto, ditto, ,, double ditto	,,	·90
Fixing deal-cased frames and sashes	,,	·07
,, fanlights or skylights	,,	·10
Labour from bench, 1-in. window linings, rebated on edge	,,	·28
Ditto 1¼-in. window-boards, with rounded nosings ...	,,	·16
Ditto 1¼-in. jamb linings, double rebated	,,	·45
Window linings, 1 in., two-panel square framed back linings	,,	·95
Ditto, ditto, bead-butt or moulded	,,	1·07
Ditto, add for each panel above two	,,	·18
Ditto, ,, ,, ,, if moulded ...	,,	·24
Ditto, add if splayed	,,	·07

Sashes and deal-cased sash-frames are usually taken together, and are priced as one item, but for the sake of simplicity they will be analysed separately.

2-*in. bevelled or moulded Bar-Sashes, and double-hung with, and including, white Flax Line and Iron Weights.* (Pulleys will be taken with the frames.)—Sashes will be dissected in the same manner as doors, assuming a certain size, and dividing by the number of superficial feet to get the price per square foot. Taking an ordinary window opening, 3 ft. wide

by 6 ft. high, and deducting 3 in. off the height for the oak sill, would give 3 ft. by 5 ft. 9 in., or 17¼ sq. ft., for the sashes. The meeting-rails overlap, and the usual construction is shown in Figs. 38 and 39. For 2-in. sash wood the most suitable battens are 4½ in. by 2 in., the bottom rail (3 in. by 2 in.) being cut out of one batten width, and the meeting-rails, top and sides (all 2 in. by 2 in.), can be cut out of half-batten widths, or 2¼ in. These widths, it will be seen, are sufficiently wide to admit of waste caused by saw-cuts and planing.

3 . 0				
. 4½	1 . 2	Bottom rail.		
3 . 0				
. 4½	1 . 2	Meeting-rails (two).		
3 . 0				
. 2¼	. 7	Top rail.		
2/5 . 8				
.2¼	2 . 1	Sides.	*s.*	*d.*
	5 . 0	ft. super. of 2-in. deal, wrot. B.S., at 4½*d*.... ...	1	10½
	22	ft. run of rebate at ¼*d*.	0	5½
	22	,, bevelling or moulding at 1*d*.	1	10
2/3 . 0	6	,, splay to meeting-rails at ¾*d*.	0	4½
	3	,, ,, bottom rail at 1*d*.	0	3
Glue and glass paper			0	1
Putting together and finishing, 3 hours carpenter at 10½*d*. ...			2	7½
8 yards sash-line at 1*d*.			0	8
4 weights, 10 lb. each = 40 lb. cast iron, at ½*d*.			1	8
Labour hanging, 3 hours carpenter at 10½*d*.			2	7½
			12	5½
Add 15 per cent. profit			1	10½
			17¼)14	4
Price per foot super.			0	10

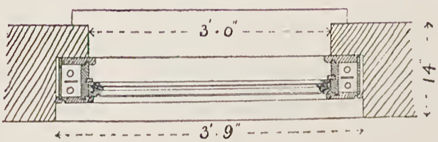

Fig. 38.

Small sashes, casements, and frames for same, 12 ft. super. and under, are worth 20 per cent. more than larger ones.

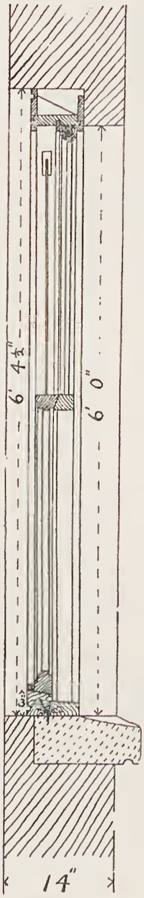

FIG. 39.

The difference between single and double hanging is $1\frac{1}{4}d.$ per foot super. All parts of windows can be finished by machinery, and fitting or fixing is often the only work which a joiner is obliged to perform.

Deal-cased Frames prepared for 2-in. Sashes, with Oak sunk and weathered Sills grooved for iron Tongue, and for Window Board if required, 1-in. Deal outside and inside Linings, 2-in. Heads, $1\frac{1}{4}$-in. Pulley Stiles, tongued to inside and outside Linings, $\frac{3}{8}$-in. Parting Beads, $\frac{1}{2}$-in. Back Linings and Parting Slips, the inside Beads $1\frac{1}{4}$ in. wide and $\frac{3}{4}$ in. thick, double hung, and including and fixing brass Axle Pulleys, and plugging to Wall.—The analysis of this item will be about the most difficult the student will have to contend with, and can only be understood by a frequent inspection of Figs. 38 and 39. The size of external window opening is 3 ft. by 6 ft., with $4\frac{1}{2}$-in. wall rebate behind, giving 3 ft. 9 in. by 6 ft. $4\frac{1}{2}$ in., or 23 ft. super. of framing.

The best and most suitable woods for use are Quebec red pine from the log, and good-quality Bjorneborgh from the batten. The entire framing must be built according to the thickness of the sashes—in this case 2 in. Battens of agreeable widths and a profitable manner of conversion ought to be adopted to avoid excessive waste. The cost of the cased frame complete will be worked out, and from this the price per square foot deduced as before.

		s.	d.
American oak sills, cut to size, up to 9 ft., cost ...	per ft. cube	4	0
,, ,, ,, 10 ft. to 15 ft.	,, ...	4	6
,, ,, ,, 16 ft. to 20 ft.	,, ...	5	0

3 . 9
. 6
. 3

		s.	d.
______ , 6	ft. cube 6 in. by 3 in. oak sill at 4s.	2	0
	Carried forward	2	0

			s.	d.
		Brought forward	2	0
3 . 9 6	1 . 11			
2/3 . 9 . 3	1 . 11			
	3 . 10	ft. super. planing on oak sill (bottom and sides) at 2*d*.	0	7½
	3 . 9	ft. run rebate or check on top of sill at 1*d*.	0	3¾
	3 . 9	ditto groove in bottom for iron tongue at ½*d*.	0	2
	3 . 9	groove in side for window board at ½*d*. ...	0	2
3 . 9 . 6	1 . 11	ft. super. (batten width), for 2-in. deal head w.o.s., at 4½*d*.	0	8½
2/3 . 0 . 4½	2 . 3	outside and inside linings (top).		
2/2/6 . 4 . 4½	9 . 6	,, ,, ,, (sides).		
	11 . 9	ft. super., 1-in. deal, w.o.s., at 2½*d*.... ...	2	5½
2/6 . 0 . 6	6 . 0	,, (batten width) for 1¼-in. pulley stiles, w.o.s. at 3*d*.	1	6
2/6 . 0 . 6	6 . 0	back linings.		
2/5 . 0 . 2½	2 . 1	parting slips.		
	8 . 1	ft. super. ½-in. rough deal at 1*d*.	0	8
3 . 0	3 . 0			
2/5 . 10	11 . 8			
	14 . 8	ft. run ⅜-in. wrot. parting bead at ¼*d*. ...	0	3¾
3 . 0	3 . 0			
2/5 . 9	11 . 6			
	14 . 6	ft. run 1¼-in. by ¾-in. wrot. inside bead at ½*d*.	0	7¼
2/3 . 9	7 . 6	Grooving for head.		
3 . 0	3 . 0	,, parting bead.		
2/5 . 10	11 . 8	,, ,,		
2/2/ . 6	2 . 0	,, pulley stiles.		
2/2/6 . 0	24 . 0	,, ,,		
2/5 . 11	11 . 10	,, back linings.		
3 . 9	3 . 9	,, inside lining.		
2/6 . 4	12 . 8	,, ,,		
	76 . 5	ft. run grooving in deal at ¼*d*.	1	7
		Carried forward	11	1¼

			s.	d.
		Brought forward	11	$1\frac{1}{4}$
		Block and wedges, say	0	4
	4	Brass axle pulleys, 2 in., at 1*s.*	4	0
3 .	6	ft. run, 1 in. by $\frac{1}{8}$ in. G. I. tongue, at 1*d.* ...	0	$3\frac{1}{2}$
	1	lb. white-lead for bedding ditto and sill, at $3\frac{1}{2}d.$	0	$3\frac{1}{2}$
Glass paper			0	1
Glue and nails			0	1
Putting together and cleaning up, 5 hours carpenter at $10\frac{1}{2}d.$ ...			4	$4\frac{1}{2}$
Labour fixing, 2 hours carpenter at $10\frac{1}{2}d.$			1	9
			22	$3\frac{3}{4}$
Add 15 per cent. profit			3	$4\frac{1}{4}$
			23)25	8
Price per foot super.			1	$1\frac{1}{2}$

There are joinery firms who will supply such sashes and frames, ready made complete, for considerably under the above rate, at $4\frac{1}{2}d.$ to 6*d.* per ft. super. delivered.

Staircases.

$1\frac{1}{4}$*-in. Treads, with rounded Nosings and small Moulding beneath, and 1-in. Risers, grooved and rebated together, glued, blocked and bracketed on, and including strong fir Carriages.*—This is the ordinary specification which Fig. 40 illustrates.

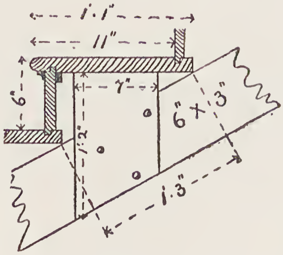

Fig. 40.

One complete step should be detailed first, and from this the cost per square foot found. Assuming each step to be 4 ft. long by 11 in. by 6 in. gives 6 ft. super. The included section of carriage which supports the tread and riser is measured on the slope.

			s.	d.
4 . 0 1 . 1	4 . 4	Ft. super. 1¼-in. deal tread, w.o.s., at 3*d*. ...	1	1
4 . 0 0 . 6	2 . 0	,, 1-in. deal riser, w.o.s., at 2½*d*. ...	0	5
2/4 . 0	8 . 0	Ft. run grooving for riser, at ¼*d*.	0	2
2/4 . 0	8 . 0	,, rebated edges for riser, at ¼*d*.	0	2
	4 . 0	,, rounded edge to 1¼-in. tread, at ¾*d*. ...	0	3
	4 . 0	,, moulding at 1*d*.	0	4
	2 . 0	,, deal blocking, at 1*d*.	0	2
4 . 0 1 . 4	5 . 4	Ft. super. planing up at 1*d*.	0	5¼
1 . 3 0 . 6 0 . 3	0 . 2	Ft. cube rough fir, carriage, at 2*s*. 10*d*.	0	5¾
	1	Rough deal bracket, 14 in. by 7 in., at 2*d*. ...	0	2
Glue and nails ...		... ...	0	1
Fixing 6 ft. super. at ·50 = 3 hours, carpenter, at 10½*d*.		...	2	7½
			6	4½
Add 15 per cent. profit		... ...	0	11½
			6)7	4
		Price per foot super.	1	3

Housing to tread and riser is priced separately, for which allow 2*d*. per foot run.

Handrails.

These are mostly made of mahogany, of which the following are the dock sale prices :—

Mahogany, Cuba,	1 in. thick	... ...	per ft. super.	6*d*. to 8*d*.
,, Honduras,	,, ,,	... ...	,,	6*d*. ,, 7½*d*.
,, Mexican,	,, ,,	... ...	,,	4*d*. ,, 5*d*.

To the foregoing, however, must be added cost of sawing, waste, and profit in conversion = 7½ per cent., so that the timber merchants' charges would be :—

				s.	d.	
Mahogany, Cuba,	1 in. thick	...	per ft. super.	1	1	average.
,, Honduras,	,, ,,	..	,,	0	8½	,,
,, Mexican,	,, ,,	...	,,	0	8	,,

The labour alone on Honduras mahogany is twice that on deal.
The labour alone on Spanish mahogany is thrice that on deal.
Labour and materials on Honduras mahogany are thrice that on deal.
Labour and materials on Spanish mahogany are four times that on deal.

4-in. by 3-in. Moulded Honduras Mahogany Handrail, and Fixed.—As mahogany is valued according to the foot super. at 1 in. thick, the above 4-in. by 3-in. section must be reduced to this denomination. And as a joint and handrail screw may be assumed at every 10 ft., such a length may be reasonably taken for the purpose of analysis, and the cost per foot run thus ascertained. 4-in. wide by 3 in. thick equals three 1-in. thicknesses of 12 in. by 4 in. area per foot run, equal 1 ft. super. per foot run.

			s.	d.
10/1 . 0 1 . 0	10 . 0	Ft. super. 1-in. mahogany, at $8\frac{1}{2}d.$	7	1
	10 . 0	Ft. run sawing out at 3*d.*	2	6
	10 . 0	,, moulding by machinery, at 6*d.* ..	5	0
Handrail screw and nut at joint			0	2
Labour to joint, $1\frac{1}{2}$ hours carpenter, at $10\frac{1}{2}d.$			1	$3\frac{3}{4}$
,, fixing 10 ft., 2 ,, ,, ,, ...			1	9
			17	$9\frac{3}{4}$
Add 15 per cent. profit			2	8
			10)20	$5\frac{3}{4}$
		Price per foot run	2	$0\frac{1}{2}$

Ramped handrail is worth twice straight.
Circular handrail is worth $2\frac{1}{2}$ times straight.
Wreathed handrail is worth 4 times straight.
Labour on mahogany handrails equals $1\frac{1}{2}$ times that on deal.

Housing Ends of 4-in. by 3-in. Handrail.—This means horizontally into newel, or woodwork. A joiner can manage three in an hour.

	d.
$\frac{1}{3}$ hour joiner at $10\frac{1}{2}d.$	$3\frac{1}{2}$
Add profit	$0\frac{1}{2}$
Price of each	4

Ditto, but on rake, are worth half as much again, or 6*d.* each.

Housings in Handrail to receive Balusters.—A joiner can

do five per hour at 10½*d.* in mahogany handrail, which with profit makes 2½*d.* each.

2-*in. turned Deal Balusters, Housed and Fixed.*—Take length at 3 ft., and include housing and fixing.

	s.	d.
3 ft. run of 2-in. by 2-in. rough deal, at 1*d.*	0	3
Labour turning, ordinary pattern	0	6
Fixing, ½-hour carpenter, at 10½*d.*	0	5¼
	1	2¼
Add profit	0	2¼
Price of each...	1	4½

Curtail End to bottom Step and fixed.—Sometimes the curtail block is made up of three pieces glued and screwed together, but here it is taken solid. Frequently it is billed "*Extra* for solid curtail step," when less than half the following price would be sufficient.

	s.	d.
Material, say 1 ft. cube of fir	1	7
Making block, 4 hours carpenter, at 10½*d.*...	3	6
Fixing ,, 1 ,, ,, ,, ...	0	10½
	5	11½
Add profit	1	0½
Price of each	7	0

SKIRTINGS.

1-*in. by* 9-*in. Torus Moulded Skirting, and Fixed.*—Skirtings in large amounts are imported ready worked, or are kept in stock at the mills. They are sold by the 100 ft. run, with an average discount of 15 per cent. off list prices, which need not be reckoned, as it is swallowed up in waste to about the same extent. Taking 100 ft. in detail—

	s.	d.
100 ft. run of 1-in. by 9-in. torus skirting	22	6
Cartage from mills to site	0	6
Cleaning up and fixing, 15 hours, carpenter, at 10½*d.*	13	1½
	36	1½
Add 15 per cent. profit	5	5½
	100)41	7
Price per foot run	0	5

Fitted ends are valued at ¾ foot run of skirting.
Housings are valued at 1 foot run of skirting.
Mitred angles are valued at 1 foot to 1½ feet run of skirting.

Roofing Felt.

Inodorous Asphalted Roofing Felt, including 2-in. Laps, and fixed with Iron Clout Nails, weighing 3 lb. per thousand, placed 3 in. apart.—The felt should be laid longitudinally from gable to gable, the same way as the roof boarding—that is, to have the joints of the boards and the joints of the felt parallel, which allows a free expansion and contraction of the boards without disturbing the surface of the felt. McNeill's felts are some of the best in the market, and their prices are :—

		£	s.	d.
Inodorous or bituminous felt, for placing under slate, tile, or metal roofs in rolls 30 yards long by 32 in. wide	per roll	1	0	0
	per yd. run	0	0	8
	per sq. ft.	0	0	1
Patent asphaltic roofing felt, makes a light, cheap, and durable roof of itself, for outside covering; in rolls 30 yards long by 32 in. wide	per roll	1	0	0
	per yd. run	0	0	8
	per sq. ft.	0	0	1
Sarking, sheathing, or slaters' felt, for placing under slate, tile or metal roofs, is of the same character as last, but thinner, in rolls 30 yards long by 32 in. wide	per roll	0	15	0
	per yd. run	0	0	6
	per sq. ft.	0	0	$0\frac{3}{4}$

From the foregoing a manufacturer's discount of 60 to 65 per cent. is taken off according to quantities ordered; but for ordinary merchant's discount reckon only half these percentages. With 2-in. laps, a square would require four widths (each 32 in. or $2\frac{2}{3}$ ft. width) each 10 ft. long = 4 × $2\frac{2}{3}$ ft. × 10 ft. = say 107 ft. super. of felt including waste.

The nails used are iron clout, about 1 in. long, and weighing 2 lb. or 3 lb. per thousand. They cost 1*s*. 4*d*. per thousand, and they should be dipped whilst hot in oil, or, if convenient, heated in a shovel and thrown into grease, which prevents them from rusting afterwards. Galvanised ditto cost a trifle extra. At 3 in. apart allow 170 to the square, with waste.

	s.	d.
107 ft. super. of inodorous felt at 1*d*. (less, say, 35 per cent. discount)	5	$9\frac{1}{2}$
170 clout nails at 1*s*. 4*d*. per 1,000	0	$2\frac{3}{4}$
Labour laying, 2 hours carpenter, at $10\frac{1}{2}$*d*.	1	9
	7	$9\frac{1}{4}$
Add 15 per cent. profit	1	$2\frac{3}{4}$
Total price per square	9	0

This is a little more than the common contract price of 8*s*. 4*d*. per square, or 1*d*. per foot super.

Mouldings.

Numerous stock patterns are easily obtainable from the moulding manufacturer, so that the builder has merely to fix them. The trade discount off stock mouldings is often as much as 40 per cent. off list prices.

			s.	*d.*
4-in.	by 1-in. architrave moulding... ...	per 100 ft. run	6	6
3-in.	by 1-in. ,, ,, ...	,,	4	6
$2\frac{1}{2}$-in.	by $\frac{3}{4}$-in. ,, ,, ...	,,	3	6
2-in.	by $\frac{3}{4}$-in. ,, ,, ...	,,	2	6
3-in.	by 2-in. moulded handrail	,,	14	6
$3\frac{1}{2}$-in.	to 5-in. girth, moulding, trade pattern	,,	17	6
$2\frac{1}{2}$-in.	to 3-in. ,, ,, ,,	,,	16	0
$1\frac{1}{2}$-in.	to 2-in. ,, ,, ,,	,,	7	6

Special mouldings, made according to working drawings, are priced by the cubic foot, and Leaning says :—

" Some estimators adopt the following scale, which includes fixing and profit :—

		s.	*d.*
2 in. by 2 in. and under	per ft. cube	12	0
2 in. by 2 in. to 4 in. by 3 in.	,,	7	6
Over 4 in. by 3 in.	,,	6	0

For the value of mitres to mouldings the estimator usually adopts a proportion of the price of a foot run, as 1 ft. for ordinary mitres, 2 ft. for irregular mitres, &c. sometimes a percentage, as 15 per cent. on the price per foot cube."

The materials for deal mouldings about equal the labour.

Seat.—1-in. deal framed w.c., 1-in. seat and riser, lid fitted with brass hinges moulded on edge, 4-in. skirting, bearers, &c., 3 ft. 6 in. wide. Items may be put down thus :—

	s.	*d.*
Deal-framed top	3	0
5 ft. 6 in. super., 1-in. deal seat, $2\frac{1}{2}d.$	1	$1\frac{3}{4}$
6 ft. super., 1-in. deal riser	1	3
Planing ditto	0	11
Cross-tonguing, say 7 ft., ·015	0	$10\frac{1}{2}$
Moulding edge of seat, 5 ft. run ·012	0	6
Skirting, about 8 ft. run, $4\frac{1}{2}$ by $\frac{3}{4}$ in.	1	4
Flap, mitre-clamped, and frame, at 9*d.*, say	2	3
Brass hinges	1	0
Labour, cutting and shaping seat	2	0
Bearers and fixing	2	6
Per seat	16	$9\frac{1}{4}$

Ditto, of Honduras mahogany, ditto, and price = $2\frac{1}{2}$ times above = 40*s.*

Various Woods.

Ash.—Ash is seldom used by the builder, but it makes good and durable gates; works well into mouldings and delicate details; can be polished, and is suitable for hand-rails, small balusters, &c. It is, however, mostly employed for the handles of implements, as it stands rough wear and tear on account of its elasticity. The timber is economical to convert because of the absence of sap; but this should be done soon after the logs are felled: otherwise deep shakes appear, and instead a heavy loss will be involved.

Ash sells by auction before felling at about 1*s.* 4*d.* per foot cube, and the merchant disposes of it in hewn logs at £8 to £11 per load of 50 ft. cube (which equals 1 ton for ash). Scantlings are 4*s.* 6*d.* per foot cube.

Elm.—This wood warps very much on account of the irregularity of its fibre, and hence is used for plugs for driving into brickwork. For this reason it should be employed in large sizes, or smaller pieces should be cut just before they are needed.

Elm realises 7*d.* to 1*s.* per foot cube before cutting down, and 55*s.* per load of 50 cubic feet in hewn logs afterwards. Scantlings are 3*s.* per foot cube.

Oak.—There are several varieties of oak, and the timber is very strong, hard, and tough, but cracks and warps a great deal in seasoning. This is especially the case with English oak, which has been largely replaced by that of foreign growth. It is said to require a year's seasoning for every inch in thickness, and even the oldest oak in ancient buildings will shrink if replaned. Foreign oak is preferable for internal joinery, as it works more easily, and does not warp or split so much as English. The latter, however, is the strongest kind.

English oak of average quality will fetch 1*s.* 6*d.* to 2*s.* 6*d.* per foot cube before felling, and it is sold by the merchant in hewn logs at 70*s.* per load of 50 c. ft. Sawn scantlings are 3*s.* 6*d.* per foot cube, and even up to 6*s.* if the stuff is of large size, dry, and well figured.

Baltic oak comes from Riga, Dantzic, Stettin, or Memel. Riga oak comes to England chiefly as wainscot logs, and is much liked for furniture, but is scarce. It costs from 50*s.* to 105*s.* per load.

			s.	*d.*
Dry wainscot,	1 in. thick, costs	per ft. sup.	0	8
,,	¾-in. floorboards cost	per square	40	0
,,	1-in. ,, ,, ...	,,	45	0
,,	1¼-in. ,, ,, ...	,,	55	0

Dantzic oak is grown chiefly in Poland, and shipped at the port after which it is named, also at Memel and Stettin. It makes excellent planks, being straight and clean in the grain, and is easily bent if boiled or steamed. Dantzic and Memel oak costs from 55*s*. to 105*s*. per load.

Austrian or Hungarian oak, shipped from Trieste, is now plentiful in the market. It costs 11*d*. per foot super., 1 in. thick, when sawn into planks or converted.

American oak is found from Canada to Carolina, and the variety mainly imported into this country is the white oak, so called from the white colour of its bark. Quebec oak costs 100*s*. to 150*s*. per load.

Labour on oak is twice that upon deal.

Labour and material are thrice the value of deal.

Labour on oak carcasing is one third more than fir.

Labour to curved work is one half more than to straight.

Waste on oak in conversion, because of its liability to twist, may be taken at 10 per cent. more than on deal, equals 20 per cent. in all for sawing and conversion. Oak and Honduras mahogany joinery are supposed to be of equal value, but the former does not work so easily as the latter, and there is more waste.

To remove English-grown timber costs 3*d*. per foot cube for loading and carriage four miles, and 1*s*. 6*d*. per ton by railway.

Yellow Pine.—This is otherwise known as Weymouth Pine, because it was first introduced by Lord Weymouth. It is sometimes referred to as white pine, from the colour of its bark. The wood is light, soft, straight-grained, free from knots, takes glue well, and very easy to work. Hence it is most suitable for joinery and fittings, especially for drawers and panels of doors, being of a clear uniform yellowish colour. It is particularly in request for iron-founders' patterns for castings. But the wood is not durable, especially when "doated" with minute grey specks or dots, the result of disease. It grows in North America, and that shipped from Quebec has the best reputation.

Yellow pine is imported both in logs and sawn into scantlings, while planks can be obtained up to 30 in. wide.

American yellow deals are classed as follows:—

Brights, 1st, 2nd, and 3rd quality, which have been sawn from picked logs, and have not been discoloured by being floated down the rivers, and are therefore of a cleaner or brighter yellow.

Dry Floated, 1st, 2nd, and 3rd quality, which have been stacked and dried before shipment after being floated down.

Floated, 1st, 2nd, and 3rd quality, which have been floated down the rivers from the felling grounds.

Quebec yellow pine in logs costs from 80*s*. to 120*s*. per load.

Yellow pine, when sawn into planks, deals, and battens is termed *American* yellow deal (Seddon). But, as stated on a former page, yellow pine and yellow deal must not be confounded.

The prices at the dock sales would be :—

	Per St. Petersburg standard.						
	£	*s.*	*d.*		£	*s.*	*d.*
Quebec yellow pine deals, 1sts...	22	0	0	to	29	0	0
,, ,, ,, 2nds	18	10	0	,,	23	0	0
,, ,, ,, 3rds	11	10	0	,,	14	0	0

A fair average rate for First bright yellow pine deals from the above would be £25 per standard.

With allowances for landing rate, unloading, sawing, conversion, &c., the cost would work out to 3*s*. per foot cube, and for thicknesses :

			s.	*d.*
Yellow pine, $\frac{1}{2}$ in. thick	... ...	per ft. sup.	0	2
,, $\frac{3}{4}$ in. ,,	... ...	,,	0	$2\frac{3}{4}$
,, 1 in. ,,	... ...	,,	0	$3\frac{1}{2}$
,, $1\frac{1}{4}$ in. ,,	... ...	,,	0	$4\frac{1}{4}$
,, $1\frac{1}{2}$ in. ,,	... ...	,,	0	5
,, $1\frac{3}{4}$ in. ,,	... ...	,,	0	$5\frac{3}{4}$
,, 2 in. ,,	... ...	,,	0	$6\frac{1}{2}$

Wooden Pattern for Stanchion.

The following analysis will show how to arrive at the price of a yellow pine pattern (usually allowed for in a bill of quantities) for casting an iron stanchion.

A pattern-maker's pay is 9*d*. per hour, but the actual rate varies from 5*s*. upwards per day. Such work as making a stanchion pattern would occupy, on the average, about half an hour per foot super. of the stuff used, with $\frac{1}{12}$th hour additional per foot run for all rounded or shaped edges and filleted angles.

The box on the top of the stanchion cannot be moulded hollow, and therefore it would be closed in and a "print" put on the end to make an impression in the sand to support the end of a "core," the weight of the other part being borne by a "chaplet." A very simple "core-box" like a brick mould would suffice, into which the sand could be rammed and the edges of the core trimmed off after it was dry. The

pattern itself is accurately formed in pine a little larger than the required casting, so as to allow for contraction in cooling.

		s.	d.
3 . 3	feet super. 1-in. yellow pine at $3\frac{1}{2}d.$	0	$11\frac{1}{4}$
20 . 2	,, $1\frac{1}{4}$-in. ,, ,, $4\frac{1}{4}d.$	7	$1\frac{3}{4}$
56 . 10	feet run arris fillets at $\frac{1}{2}d.$	2	$4\frac{1}{2}$
3 . 3			
20 . 2			
23 . 5	feet super. at $\frac{1}{4}d.$ for nails and screws	0	6
23 . 5	,, $\times \frac{1}{2}$ hour $= 11\frac{1}{2}$ hours pattern-maker at $9d.$	8	$7\frac{1}{2}$
96 . 3	feet run $\times \frac{1}{12}$ hour $=$ 8 hours ditto for shaped edges ...	6	0
		25	7
Add 15 per cent. profit	... ...	3	11
	Total price of pattern	29	6

Pitch Pine.—The best of this timber comes from the United States, from the ports of Georgia, Pensacola, Darien, Savannah, &c. It is heavy, strong, free from knots, well marked, and full of resin, but is liable to shakes. From its beauty of figure it is much in demand for joinery that is to be finished without paint, especially as the resin prevents the paint from adhering properly. Though the resinous matter makes the wood extremely durable, it causes it to be sticky and difficult to plane. Hence it is classed as a hard wood, and the cost of working is usually considered to be on an average 50 per cent. more than on deal. Old and dry pitch pine is particularly hard to work. Sawing is charged at one-third more than for deal.

Pitch pine can be obtained 9 to 18 in. square, from 20 ft. to 65 ft. long. Being subject to heart-shakes and cup-shakes, it is more economical to purchase it in the form of planks when it is required to be used in that way. The cost at the docks is 70*s.* per load.

The following are the prices for thicknesses after conversion :—

			s.	d.
Pitch pine,	$\frac{1}{2}$ in. thick	per foot sup.	0	$1\frac{1}{4}$
,,	$\frac{3}{4}$ in. ,, ...	,,	0	$1\frac{3}{4}$
,,	1 in. ,, ...	,,	0	$2\frac{1}{4}$
,,	$1\frac{1}{4}$ in. ,, ...	,,	0	$2\frac{3}{4}$
,,	$1\frac{1}{2}$ in. ,, ...	,,	0	$3\frac{1}{4}$
,,	$1\frac{3}{4}$ in. ,, ...	,,	0	$3\frac{3}{4}$
,,	2 in. ,, ...	,,	0	$4\frac{1}{4}$

The labour and material in pitch-pine jamb linings, wall-strings, skirtings, seats, doors, framings, newels, handrails, &c., are 25 per cent. more than in deal—sometimes 33 per cent. Labour alone is 50 per cent. more than for deal.

Mahogany.—This now comes from Cuba, St. Domingo, Tabasco, Honduras, Mexico, Panama, and Africa.

Cuba, or Spanish, mahogany is the best and most expensive. It is beautifully figured, with small white specks, sound, and of a yellowish colour when polished. The logs are 20 ft. to 30 ft. long, and from 12 in. to 24 in. square. It is the hardest, the labour on it being about three times as great as that on yellow deal. Good Cuba mahogany costs 50 per cent. more than Honduras.

St. Domingo, or Hayti, mahogany is as good as Cuba, hard and heavy, but is smaller, and getting scarce. The logs do not exceed 10 ft. in length and 12 in. square.

Tabasco mahogany is the next best, and is often substituted for the preceding kinds. It is imported in logs 20 ft. to 30 ft. long and 15 in. to 36 in. square.

Honduras, or Bay, mahogany is found round the Bay of Honduras in great quantity. It is sometimes called Bay-wood. The wood is of a reddish-brown colour, without figure, and more coarse and even in grain than Spanish mahogany. Honduras mahogany is the most easily worked, and is chiefly shipped from Belize. The logs are about 14 ft. long and 2 ft. to 4 ft. square.

Mexican mahogany possesses the same characteristics as that from Honduras. The wood is coarse, spongy in the centre, and liable to star-shakes, and latterly the sizes have been small.

Panama mahogany is also like Honduras, but short, badly shaped, and badly cut.

African mahogany comes from the neighbourhood of Senegal, but although close and hard of texture, it is comparatively inferior. The import, however, is increasing, as the quality has greatly improved of late. Half the stock of mahogany now held in London is African, and the proportion is much greater in Liverpool. The logs are up to 36 ft. long, and from 1 to 3 ft. square.

Mahogany has the peculiar property of taking a firm hold of glue, and it contains no acids, which would be injurious to metal fastenings. The qualities of the many varieties differ enormously in value, and the inferior kinds are frequently stained before polishing, to pass muster.

In selling by auction, the trade custom is to charge for

only 70 per cent. of the cubical contents of the logs, as the rest is supposed to be wasted in cutting into thicknesses. As stated under "Handrails," the London dock sale prices are :—

						d.		*d.*
Mahogany, Cuba	1 in. thick ...	...	...	per ft. sup.		6	to	8
,,	Honduras	,,	...	...	,,	6	,,	7½
,,	Mexican	,,	...	...	,,	4	,,	5
,,	Jamaican	,,	...	...	,,	3½	,,	5
,,	African	,,	...	...	,,	3½	,,	5½

Teak.—The best teak is found in Burmah, the two principal ports for shipment being Moulmein and Rangoon. It also grows in India, Java, and Siam. The colour is mostly a rich brown, and the wood is strong and easily worked, somewhat resembling oak. If not tooled with care it is very liable to splinter, and it contains a resinous oil which makes it durable and tends to preserve iron fastenings. The so-called "African teak" is an inferior wood of quite a different kind. Teak is coming more and more into building use, being greatly employed for shop fittings, joinery, and sills for sash frames. On account of the oil in the pores it makes a splendid floor for dancing. The cost of working is about twice that on yellow deal.

The timber is sorted in the markets according to size, not quality, and the logs can be obtained up to 40 ft. long and 2 ft. wide or more. Burmah teak costs from £10 to £18 per load.

American Walnut.—Much of this comes from Baltimore, being shipped in logs 10 to 20 ft. long and 12 in. to 22 in. square. That imported from Quebec is cheaper, paler, and softer. It is a hard and durable wood, beautifully grained, and in hardness the best American walnut is about equal to oak. It answers well in shopfronts, &c.

Dry American black walnut costs 11*d*. per foot super., 1 in. thick.

Fixing Ironwork.

The fixing only of straps, shoes, &c., is priced at per cwt., and of smaller articles, such as bolts, &c., at per lb. The rate decreases as the weight increases. Some labour constants are :—

			Hours of a Carpenter.
Fixing only, cast-iron heads and shoes...		per cwt.	6·00
,,	wrought-iron straps, ties, &c. (about 13 lb. per hour)...	per lb.	·08
,,	,, bolts under 1 lb.	,,	·27
,,	,, ,, 1 lb. and under 2 lb.	,,	·22
,,	,, ,, 2 lb. ,, 4 lb.	,,	·16
,,	,, ,, 4 lb. ,, 8 lb.	,,	·11
,,	,, ,, 8 lb. and upwards ...	,,	·08

Fixing to oak, teak, and pitch pine is worth 50 per cent. more than to fir.

Ironmongery.

All ironmongery should be specified to be of such a description as to be classed first-rate articles of their respective kinds. The prices in catalogues do not include screws, builders as a rule keeping an assorted stock of these on hand, obviating the necessity of the merchant to supply screws with ordered articles of ironmongery. Where a quantity of goods of a similar description is required, a special quotation will be furnished by firms of ironmongers on application. All ironmongery within town limits (*i.e.* Carter, Paterson, & Co.'s radius of about 10 miles) is delivered free, as also to the care of the several railway companies for the country. Articles made to order are not returnable.

The maker's trade discount varies from 12 to 30 per cent. for dozens and upwards, wholesale terms. Allow in the following items, say, 20 per cent., which the builder may take as additional profit, and ignore in analysing his prices if he so wishes.

The prices of ironmonger's work are easily arrived at, and a few samples will suffice. For fixing to hardwood allow one-fifth extra on fixing to deal.

The following constants for fixing in deal may be useful:—

	Hours of a Joiner.				Screws.	
			s.	*d.*	*s.*	*d.*
2½-in. butts, per pair	·22	=	0	2¼	0	1
3½-in. ,, ,,	·27	=	0	2¾	0	1¼
4-in. ,, ,,	·33	=	0	3¼	0	2
5-in. ,, ,,	·37	=	0	3¾	0	2¼
15-in. Cross garnet hinges	·53	=	0	5¼	0	1½
3 to 6-in. Tower bolts	·43	=	0	4¼	0	1
9 to 12-in. ,,	·65	=	0	6½	0	1
Espagnolette bolts, per inch	·06	=	0	0½	0	0¼
Flush bolts, per inch	·08	=	0	0¾	0	0¼
3-in. cupboard locks	·40	=	0	4	0	1
Rim locks	·95	=	0	9½	0	1
Mortise locks	2·52	=	2	1¼	0	1
Kaye's locks	2·86	=	2	4½	0	1
Rim dead locks	·95	=	0	9½	0	1
10-in. drawback locks	1·70	=	1	5	0	1
Door-knob	·33	=	0	3¼	0	0
Night latch	·85	=	0	8½	0	0
Knocker	1·26	=	1	0½	0	0

6-*in. Brass Barrel Bolt, and Fixed.*—The quality, not being specially mentioned, "medium" would be taken, and, of course, brass screws are understood for fixing brass articles.

	s.	d.
6-in. brass barrel bolt at 2s., ...	2	3
6 brass screws, ½-in. No. 8 gauge, at 2s. 3d. per gross	0	1
Fixing, ⅓ hour joiner, at 10½d.	0	3½
	2	7½
Add 15 per cent. profit	0	4½
Price of each	3	0

3-in. Brass Spring Quadrant Sash-Fastener, and Fixed.—These are commonly sold by the dozen, and the make should be strong. Patent sash-fasteners are innumerable.

	s.	d.
3-in. brass sash-fastener at 17s. per dozen	1	5
8 brass screws at 2s. 3d. per gross	0	1½
Fixing, ⅓ hour joiner, at 10½d.	0	3½
	1	10
Add 15 per cent. profit	0	3
Price of each...	2	1

Hinges are fixed with the hanging of the doors, so that in "*Ironmonger*" they are "supplied only." Butt hinges are narrow, medium, or broad. Medium ones take eight or ten screws per pair, which should be 1¼ in. or 1½ in. long. Cross-garnet hinges are light or strong, and require rather more screws.

Middling Suffolk Thumb-latch, and Fixed.—Good wrought-iron latches of this description are catalogued at 11s. 6d. per dozen, and need about a dozen screws for fixing.

	s.	d.
W. I. thumb-latch at 11s. 6d. per dozen	0	11½
1 dozen iron screws at 1s. 3d. per gross	0	1¼
Fixing, ½ hour joiner, at 10½d.	0	5¼
	1	6
Add 15 per cent. profit	0	2½
Price of each...	1	8½

7-in. Iron Rim Lock, including Brass Furniture, and Fixed.—Locks should be very accurately described, as they differ more than any other kind of ironmongery. The full description for such a good lock would include fine ward, strong cranked tail, box staple, and Mace's strong brass furniture. The latter would embrace 2-in. cast brass knobs with solid

necks, cast rose and escutcheon, and wrought-iron spindle. Dead-shot locks have no handle, but are acted on by a key only. Locks in mechanism are also single-bolt, two-bolt, or three-bolt, and having bushed wards, &c.

	s.	d.
7-in. iron rim lock at 39*s*. per dozen	3	3
Mace's furniture, extra, at 6*s*. 6*d*. per dozen	0	6½
Iron screws not provided	0	1
Fixing, 1 hour joiner, at 10½*d*.	0	10½
	4	9
Add 15 per cent. profit	0	9
Price of each...	5	6

The furniture for mortise locks may be kept and priced separately, as it is generally selected by the architect. For plain brass furniture, 2*s*. 6*d*. per set is a fair price.

A joiner can fix four mortise locks, 6 in. × ⅝ in., per day on an average, including sinking mortise and fixing the lock and furniture complete. By an effort he will even do six. Say two hours per lock.

From the foregoing typical cases it will be seen that the analysis of all ironmongery items merely consists of cost of the article, screws, and fixing, plus profit.

CHAPTER XIV.

SMITH AND IRON FOUNDER AND COPPER-SMITH AND BELLHANGER.

MEMORANDA.

Cast iron	weighs 450 lb.	per ft. cube
Wrought iron...	,, 485 lb.	,,
Steel	,, 490 lb.	,,

Cubic inches of wrought iron × ·28 = lb.
,, ,, ,, ÷ 100 = qr.
,, ,, ,, ÷ 400 = cwt.

1 ft. super. of	wrought iron	1 in. thick	= $40\frac{1}{3}$ lb.
,,	cast iron	,,	= $37\frac{1}{2}$,,
,,	steel	,,	= 41 ,,
,,	copper	,,	= 46 ,,
,,	brass	,,	= 45 ,,
,,	lead	,,	= 59 ,,
,,	zinc	,,	= $37\frac{1}{2}$,,

Multiply by 12 to obtain the weight per foot cube.

Iron expands or contracts $\frac{1}{150000}$ of its length for every degree Fahr.

Weight of wrought iron	× ·93 =	weight of zinc.
,, ,,	× ·93 =	,, cast iron.
,, ,,	× ·94 =	,, tin.
,, ,,	× 1·02 =	,, steel.
,, ,,	× 1·09 =	,, brass.
,, ,,	× 1·15 =	,, copper.
,, ,,	× 1·47 =	,, lead.

One rough rule to find the weight of castings is to multiply the weight of deal pattern by 17.

Weight of Bolt Heads and Nuts in Lbs.

Description.	Diameter of Bolt in Inches.								
	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
Hexagon head and nut......	·128	·267	·43	·73	1·10	2·14	3·78	5·6	8·75
Square head and nut......	·164	·320	·55	·88	1·31	2·56	4·42	7·0	10·50

The legal standard wire gauge is :—

				per sq. ft.
No. 14 S.W.G.	to be	0·080 in.	thick, and to weigh	3·20 lb.
,, 16	,,	0·064	,, ,,	2·56 ,,
,, 18	,,	0·484	,, ,,	1·92 ,,
,, 20	,,	0·036	,, ,,	1·44 ,,

Birmingham makers' weights are :—

No. 18	to weigh	2·87 lb.	per square foot.
,, 20	,,	2·24 ,,	,,
,, 22	,,	1·79 ,,	,,
,, 24	,,	1·45 ,,	,,

Tables of weights of different sections are indispensable in calculating the weight per foot lineal of L, T, I channel and other iron; but the following rule is useful. Multiply sectional area in square inches by 10, and divide by 3. For example, a wrought-iron T-iron is 4 in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. The area is $3\frac{3}{4}$ sq. in., and

$$\frac{3·75 \times 10}{3} = 12·5 \text{ lb. per lineal foot.}$$

SHEET IRON—WEIGHT OF A SQUARE FOOT.

S.W. Gauge.	Thickness.	Weight.	S.W. Gauge.	Thickness.	Weight.
No.	in.	lb.	No.	in.	lb.
1	·300	12·125	16	·064	2·587
2	·276	11·155	17	·056	2·263
3	·252	10·185	18	·048	1·940
4	·232	9·377	19	·040	1·617
5	·212	8·468	20	·036	1·455
6	·192	7·760	21	·032	1·293
7	·176	7·113	22	·028	1·132
8	·160	6·467	23	·024	·970
9	·144	5·820	24	·022	·889
10	·128	5·173	25	·020	·808
11	·116	4·688	26	·018	·727
12	·104	4·203	27	·016	·663
13	·092	3·718	28	·014	·598
14	·080	3·233	29	·013	·550
15	·072	2·910	30	·012	·501

ROUND AND SQUARE IRON—WEIGHT OF A LINEAL FOOT.

Iron.	Diameter or Side in Inches.											
	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Round........	·165	·661	1·49	2·65	4·13	5·96	8·10	10·58	13·39	16·53	20·20	23·80
Square	·210	·842	1·90	3·37	5·26	7·58	10·32	13·47	17·05	21·05	25·47	30·31

FLAT BAR IRON—WEIGHT OF A LINEAL FOOT.

Width in Inches.	Thickness in Inches.								
	1/16	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1/16	·0132	·0263	·0526	·0789	·1053	·1316	·1579	·1842	·2105
1/8	·0263	·0526	·1053	·1579	·2105	·2631	·3158	·3684	·4210
1/4	·0526	·1053	·2105	·3158	·4210	·5263	·6315	·7368	·8420
3/8	·0789	·1579	·3158	·4736	·6315	·7894	·9473	1·105	1·263
1/2	·1053	·2105	·4210	·6315	·8420	1·053	1·263	1·474	1·684
5/8	·1316	·2631	·5263	·7894	1·053	1·316	1·579	1·842	2·105
3/4	·1579	·3158	·6315	·9473	1·263	1·579	1·895	2·210	2·526
7/8	·1842	·3684	·7368	1·105	1·474	1·842	2·210	2·579	2·947
1	·210	·421	·842	1·263	1·684	2·105	2·526	2·947	3·368
1 1/2	·316	·632	1·263	1·895	2·526	3·158	3·789	4·421	5·052
2	·421	·842	1·684	2·526	3·368	4·210	5·052	5·894	6·736
2 1/2	·526	1·053	2·105	3·158	4·210	5·263	6·315	7·368	8·420
3	·632	1·263	2·526	3·789	5·052	6·315	7·578	8·841	10·104
3 1/2	·737	1·474	2·947	4·421	5·894	7·368	8·841	10·315	11·788
4	·842	1·684	3·368	5·052	6·736	8·420	10·104	11·788	13·472

Sheet Metal—Weight of a Square Foot.

(Birmingham Wire Gauge.)

B.W.G.	Iron.	Copper.	Brass.	B.W.G.	Iron.	Copper.	Brass.
No.	lb.	lb.	lb.	No.	lb.	lb.	lb.
1	12·50	14·50	13·75	16	2·50	2·90	2·75
2	12·00	13·90	13·10	17	2·18	2·52	2·40
3	11·00	12·75	12·10	18	1·86	2·15	2·04
4	10·00	11·60	11·00	19	1·70	1·97	1·87
5	8·74	10·10	9·61	20	1·54	1·78	1·69
6	8·12	9·40	8·93	21	1·40	1·62	1·54
7	7·50	8·70	8·25	22	1·25	1·45	1·37
8	6·86	7·90	7·54	23	1·12	1·30	1·23
9	6·24	7·20	6·86	24	1·00	1·16	1·10
10	5·62	6·50	6·18	25	·90	1·04	·99
11	5·00	5·80	5·50	26	·80	·92	·88
12	4·38	5·08	4·81	27	·72	·83	·79
13	3·75	4·34	4·12	28	·64	·74	·70
14	3·12	3·60	3·43	29	·56	·64	·61
15	2·82	3·27	3·10	30	·50	·58	·55

Weight of Cast-iron Socket-Pipes.

For a head of water 300 ft. and under :—

Bore.	Length when laid.	Length of Socket.	Thickness of Metal.	Weight of each Pipe.	Size of Lead Joint.	Weight of Lead Joint.
in.	ft.	in.	in.	lb.	in. in.	lb.
2	6	3	$\frac{5}{16}$	51	$1\frac{1}{2} \times \frac{1}{4}$	1·4
3	9	$3\frac{1}{2}$	$\frac{3}{8}$	121	$1\frac{3}{4} \times \frac{1}{4}$	2·3
4	9	4	$\frac{3}{8}$	157	$2 \times \frac{5}{16}$	4·0
5	9	4	$\frac{7}{16}$	233	$2 \times \frac{5}{16}$	5·0
6	9	$4\frac{1}{4}$	$\frac{1}{2}$	314	$2\frac{1}{4} \times \frac{5}{16}$	6·5
9	9	$4\frac{1}{2}$	$\frac{9}{16}$	527	$2\frac{1}{2} \times \frac{5}{16}$	10·4
12	9	$4\frac{1}{2}$	$\frac{5}{8}$	755	$2\frac{3}{4} \times \frac{3}{8}$	18·2
15	9	$4\frac{1}{2}$	$\frac{5}{8}$	948	$2\frac{3}{4} \times \frac{3}{8}$	22·2
18	9	$4\frac{1}{2}$	$\frac{5}{8}$	1,365	$2\frac{3}{4} \times \frac{3}{8}$	26·6

Approximate weights of rain-water pipes :—

3 in.	$3\frac{1}{2}$ in.	4 in.	$4\frac{1}{2}$ in.	5 in.	6 in.
13	15	18	21	25	28 lb. per yard.

Approximate weights of eaves-gutters :—

	3 in.	$3\frac{1}{2}$ in.	4 in.	$4\frac{1}{2}$ in.	5 in.	6 in.
Half-round	$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	7	$8\frac{1}{2}$	$11\frac{1}{2}$ lb. per yard.
Ogee ...	$6\frac{1}{2}$	7	8	9	10	13 ,, ,,

A table of the standard sizes, thicknesses, and weights of cast-iron water-pipes adopted by Messrs. Cochrane & Co. is appended :—

STANDARD WATER-PIPES, MESSRS. COCHRANE & CO., DUDLEY.

Diameter.	Thickness.	Length.	Weight.			Diameter.	Thickness.	Length.	Weight.		
in.	in.	ft.	cwt.	qr.	lb.	in.	in.	ft.	cwt.	qr.	lb.
2	$\frac{3}{8}$	6	0	2	0	12	$\frac{5}{8}$	12	9	0	0
$2\frac{1}{2}$	$\frac{3}{8}$	6	0	2	14	14	$\frac{5}{8}$	12	10	1	0
3	$\frac{3}{8}$	9	1	0	14	15	$\frac{3}{4}$	12	12	3	0
4	$\frac{3}{8}$	9	1	2	0	16	$\frac{3}{4}$	12	13	3	0
5	$\frac{7}{16}$	9	2	0	0	20	$\frac{7}{8}$	12	21	0	0
6	$\frac{7}{16}$	9	2	2	0	24	$\frac{7}{8}$	12	25	0	0
8	$\frac{1}{2}$	9	3	3	0	30	1	12	35	0	0
9	$\frac{9}{16}$	9	4	3	0	36	1	12	43	0	0
10	$\frac{5}{8}$	9	5	3	14	42	1	12	50	2	0

Messrs. Cochrane & Co. do not recommend a less thickness than from $1\frac{1}{8}$ in. to $1\frac{1}{4}$ in. for pipes of 42 in. and upwards in diameter.

CORRUGATED IRON ROOFING

Is usually made in sheets 6 ft. to 8 ft. long and 2 ft. to 3 ft. wide.

S.W. Gauge.	Size of Sheets.	Weight per Square as laid.	Square Feet per Ton before laying.
No.	ft. ft. ft. ft.	lb.	
16	6 × 2 to 8 × 3	363	746
18	6 × 2 to 8 × 3	274	957
20	6 × 2 to 8 × 3	203	1,355
22	6 × 2 to 7 × $2\frac{1}{2}$	162	1,538
24	6 × 2 to 7 × $2\frac{1}{2}$	140	1,866
26	6 × 2 to 7 × $2\frac{1}{2}$	112	2,354

If the sheets are galvanised, add $\frac{1}{100}$th part to the weights in the table. Sheets should overlap about 6 in., and be double-riveted at the joints. A side intersection of two corrugations should be given. Three pounds of rivets are required for each square of roofing.

For Cisterns.

One cubic foot contains $6\frac{1}{4}$ gallons; 1 gallon of water weighs 10 lb., and 1 ft. cube weighs $62\frac{1}{2}$ lb.

Copper.

The most useful form for the builder in which sheet-copper is sold is in sizes measuring about 4 ft. by 2 ft., and described according to their thickness (by the Birmingham Wire Gauge) and their weight per foot super. The gauges of the sheets vary from No. 1 to 30 W.G.

Weight of Copper Pipes per Foot Run.

(Brass pipes weigh a little less.)

Bore.	Thickness in Parts of an Inch.			
	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$
	lb.	lb.	lb.	lb.
$\frac{1}{4}$ in.	·23	·56	·99	—
$\frac{1}{2}$ in.	·42	·94	1·60	2·27
$\frac{3}{4}$ in.	·62	1·33	2·17	3·02
1 in.	·79	1·69	2·66	3·77
$1\frac{1}{4}$ in.	1·00	2·08	3·26	4·51
$1\frac{1}{2}$ in.	1·15	2·44	3·85	5·30
2 in.	1·55	3·21	5·00	6·80

1-in. round copper bar weighs 3 lb. per foot run.
1-in. square ,, ,, ,, 4 ,, ,,

Ordinary Washing Coppers.

To hold 5 gallons weighs $7\frac{1}{2}$ pounds.
,, 10 ,, ,, 15 ,,
,, 15 ,, ,, $22\frac{1}{2}$,,
,, 20 ,, ,, 30 ,,
,, 30 ,, ,, 45 ,,
,, 40 ,, ,, 60 ,,
,, 50 ,, ,, $75\frac{1}{2}$

PRICES.

Wrought Iron.

Wrought iron, best Staffordshire, in bar, plate, or hoop and to be of any pattern. The prices include all drilling, punching, countersinking for screws, filing, &c.

PRICES OF WROUGHT IRON—*continued.*

Description.		Supplied only.		Add if Fixed.	
		s.	d.	s.	d.
Angle and tee-iron bars	per lb.	0	2½	0	0½
Balusters, shouldered, countersunk, &c., for staircases	,,	0	3¼	0	0½
Extra only for turning ditto	each	2	0	—	
Bars for chimney, bearing bars, &c.	per lb.	0	1¾	0	0¼
,, for windows, pointed and heeled	,,	0	2¼	0	0¼
Pointed ends to ditto taken separately	each	0	3½	—	
Bars and rails for windows, with holes drilled in rails for bars, ends of rails prepared for riveting, or for fixing into stone or brick-work, or to wood with screws	per lb.	0	2½	0	0¼
Bolts with hooks or rings at one end and prepared for riveting, or jagged or lewised at the other end, including washers, under 1 lb. weight each	,,	0	4½	0	2½
Ditto, 1 lb. and under 2 lb. ditto	,,	0	3½	0	2
Ditto, 2 lb. ,, 4 lb. ,,	,,	0	3¼	0	1½
Ditto, 4 lb. ,, 8 lb. ,,	,,	0	3	0	1
Bolts, screw, prepared with heads, nuts, and washers, under 1 lb. each	,,	0	5	0	2½
Ditto, 1 lb. and under 2 lb. ditto	,,	0	4	0	2
Ditto, 2 lb. ,, 4 lb. ,,	,,	0	3¾	0	1½
Ditto, 4 lb. ,, 8 lb. ,,	,,	0	3¼	0	1
Bolts for gutters, 1½ in. long, with head, screw, and nut	per doz.	0	3½	0	6
Bolts, running, for doors or gates, home made, on plate, above 12 in. long, including hasps, staples, &c.	per lb.	0	8	0	1¼
Brackets for eaves gutters, &c.	,,	0	3½	0	0¾
Cramps	,,	0	2¼	0	0½
Fishplates, bands, &c.	,,	0	3	0	0½
Dog irons	,,	0	2	0	0½
Framing of angle, tee, or bar iron, &c., as in iron buildings, including all fitting, drilling, bolts, &c.	per cwt.	18	0	2	0
Gratings, framed or of plate iron, perforated, straight, or curved, for drains, ventilators, &c., under 14 lb. weight	per lb.	0	4	0	0½
Ditto, 14 lb. and upwards	,,	0	3½	0	0½
Add if with frame and hinged	,,	0	0¾	—	
Holdfasts for door-frames, drilled and countersunk, &c.	,,	0	2½	0	0½
Holdfasts, rings, &c., ½ lb. each and under, japanned	,,	0	3	0	1
Rails, hand, half-round, drilled for balusters and screws	,,	0	3¼	0	0½
Rings, manger, with nuts and rivets, &c.	,,	0	7¼	0	1½
Rope, wire, galvanised	per cwt.	23	0	4	0
Sashes, wrought and rolled iron, with moulded or bevelled bars, under 20 ft. super.	,,	33	0	—	

Prices of Wrought Iron—*continued.*

Description.	Supplied only.		Add if fixed.	
	s.	*d.*	*s.*	*d.*
Steel, or wrought iron, in rolled joists, angle or tee-iron, cut to length, including holes for bolts or bars .... per cwt.	10	6	1	9
Scrolls to handrails, extra only .... each	1	10	0	6
Screws, stove, ¾ in. long .... per doz.	0	1½	0	3½
,, ,, 1 in. ,, ... ,,	0	1½	0	4
,, ,, 1½ in. ,, ... ,,	0	3	0	6½
Shoes, straps, or rings for piles, including nails per lb.	0	2¾	0	0¾
Straps, bolts, nuts, keys, wedges, &c., for trusses .... ,,	0	4¼	0	0½
Strap hinges, bolted with bolts taken elsewhere ,,	0	5	0	0½
Wrought iron in roof trusses, with bolts, nuts, &c. .... per cwt.	22	6	2	0
Purlins and rafters, of angle or tee-iron, fitted complete, or tie-rods screwed and fitted...... ,,	16	6	1	6
Galvanised corrugated sheet iron to roofs, including bolts, nails, screws, rivets, &c., No. 12 to 14 S.W. gauge ....per ft. sup.	0	8½	0	2½
Ditto, ditto, No. 15 to 17 gauge .... ,,	0	8	0	2½
Ditto, ditto, No. 18 to 20 ,, ... ,,	0	7½	0	2½
Ditto, ditto, No. 21 to 24 ,, ... ,,	0	7	0	2½

		s. *d.*		*s.* *d.*
Wrot.-iron sashes, according to number of squares,	per foot super.	0 10	to	2 0
Fixing only stirrup straps, 4 ft. 6 in. long	each			0 6
,, ,, gibs and cotters	per set			0 6
2-in. by ¾-in. coach-head screws, and fixing in cast iron ...	each			0 2
2-in. strong gun-metal friction rollers, with steel pivots and brass plates, and letting into deal	,,			10 0
Galv. wrot.-iron steps for manholes, "U" pattern ...	,,			3 5

Galvanised Piping.

Stout wrought-iron lap-welded steam and water pipes and connections, with plain screwed socket-joints, &c., to withstand a hydraulic pressure of not less than 400 lb. per square inch.

Internal Diameter	½ in.		¾ in.		1 in.		1¼ in.		1½ in.		2 in.	
Weight per Foot Run........	1·08 lb.		1·57 lb.		2·24 lb.		3·2 lb.		3·96 lb.		5·43 lb.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Galv. W.I. welded pipe, with plain screwed socket, from 2-ft. to 12-ft. lengths, supplied only......per ft. run	0	3	0	4	0	6	0	8	0	10	1	3
Add if fixed, including hooks, red-lead, &c.....per ft. run	0	1¾	0	2	0	2¼	0	2½	0	2¾	0	3¼

Galvanised Piping—*continued.*

Internal Diameter	½ in.	¾ in.	1 in.	1¼ in.	1½ in.	2 in.
Weight per Foot Run.........	1·08 lb.	1·57 lb.	2·24 lb.	3·2 lb.	3·96 lb.	5·43 lb.
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Add for covering pipes with two layers of stout hair-felt secured with wire .. per yd. run	0 7	0 8½	0 9	0 11	1 0	1 2½
Short piece, under 2 ft., supplied only ....each	0 6	0 8	0 10	1 0	1 3	2 0
Connecting pieces, or long screws, supplied only..each	0 8	0 10	1 1	1 4	1 8	2 9
Bends, elbows, or springs, supplied only........each	0 6	0 8	0 11	1 3	1 7	2 10
Tees, equal or diminishing, supplied only........each	0 6	0 8	0 11	1 3	1 7	2 8
Crosses, equal or diminishing, supplied only....each	1 0	1 3	1 7	2 0	2 5	3 6
Sockets, nipples, caps, plugs, nuts, supplied only ..each	0 3	0 3½	0 4	0 5¼	0 6½	0 9
Brass barrel union joints, for iron pipe, supplied only ....each	1 4	2 4	3 4	4 6	6 3	10 0
Brass barrel union joints, for steam pipe, supplied only ....each	2 10	3 8	4 9	6 4	8 6	12 0
Add to last eight items if fixed................each	0 2	0 2½	0 3	0 3¼	0 3½	0 4
Galv. iron hooks for piping per 100	1 5½	2 3½	2 10	3 9	4 10	6 0

Deduct, if butt-welded pipes are used instead of lap-welded, 10 per cent.

Iron Founder.

Of soft grey iron, from the second melting, cast sound and clean.

Description.		Supplied only.	Add if Fixed.
		s. d.	*s. d.*
In sand, as furnace bars, sash weights, and similar articles..	per cwt.	7 0	—
Backs and boilers for ranges, grates, &c.	,,	12 6	1 6
Balusters, plain or ornamental, drilled and tapped	,,	15 0	2
Cisterns, tanks, &c., in one piece.................	,,	10 6	0 10
Ditto, put together, including iron cement or red lead..	,,	11 0	2 0
In plates, washers, joists, posts, girders, &c., and drilling	,,	9 9	1 3
In hollow columns, with caps and bases, lamp-posts, &c.	,,	12 0	1 9

IRON FOUNDER—*continued.*

Description.		Supplied only.		Add if Fixed.	
		s.	d.	s.	d.
Open framing of any kind, as braces, brackets, carriages, &c., including drilling and fitting up, small bolts, nuts, or screws	per cwt.	17	0	2	3
Add if in single articles under 7 lb. weight, purpose made	,,	5	0	2	0
Furnace fronts, soot doors, steam flues, with W.I. fastenings	,,	15	6	2	0
Gratings and frames, for drains, stoves, &c....	,,	10	0	0	10
,, ,, ,, hinged	,,	11	6	0	10
,, ,, perforated for ventilators	,,	14	0	0	10
Heads and shoes for roof trusses, including drilling	,,	12	6	1	6
Pipes of any thickness or length, 1 to 24-in. bore, socket joints	,,	7	6	—	
Add, if with turned and bored spigots and sockets	,,	2	6	—	
Pipes, with flanged joints, and fitted for screw bolts and nuts....................................	,,	9	6	—	
Branches, bends, collars, caps, &c., extra only to price of pipes	,,	3	6	—	
Sashes and frames, skylights and lantern lights	,,	21	0	2	0
Socket shoes, with tenons, for door frames, drilled	per lb.	0	2½	0	4
Ditto, ditto, for 5-in. by 4-in. door frame, 4 lb.	each	1	0	0	6

		s.	d.
Cast-iron ornamental cantilever brackets, 3 ft. by 3 ft., weighing 63 lb. each, bolted and fixed to iron columns, &c.	each	18	0
Pattern for ditto, to serve for right or left	,,	10	0
Pattern for cast-iron column, 8 ft. 6 in. long, 3½ in. diameter	,,	10	0
Jones', G. I., manhole cover and frame, 24 in. by 17 in., supplied only	,,	48	6
Ditto, ditto, 26 in. by 20 in., ditto	,,	74	0

Eavesgutters, Rainwater Pipes, &c.	Supplied only, including holdfasts, spikes, brackets, bolts, and nuts.								Add if fixed including joints.	
	3 in.		3½ in.		4 in.		5 in.			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Rainwater gutters, semi-circular ....per ft. run	0	4	0	4½	0	5	0	6½	0	1½
Ditto, pipes, round... ,,	0	7	0	8½	0	10	1	2	0	1
Ditto, hopper heads, flat each	2	8	3	3	4	0	5	0	0	4
Perforated covers for heads.......... .... ,,	1	2	1	4	1	6	1	9	0	2

IRON FOUNDER—*continued.*

Eavesgutters, Rainwater Pipes, &c.		Supplied only, including holdfasts, spikes, brackets, bolts, and nuts.				Add if fixed including joints.
		3 in.	3½ in.	4 in.	5 in.	
		s. d.	s. d.	s. d.	s. d.	s. d.
Add *extra* to pipes for shoes, bends, swan necks, &c.	each	1 1	1 4	1 7	1 10	0 3
Ditto to gutters for angles or bends	,,	0 7	0 8	0 9	0 11	0 2
Ditto, ditto for stopped ends	,,	0 7	0 8	0 9	0 11	0 2
Ditto, ditto, for nozzles or outlets	,,	0 7	0 8	0 9	0 11	0 2
Clips for rain-water gutters	,,	0 6	0 6½	0 7	0 11	0 2
Ditto, ditto, lionheaded	,,	0 8	0 9	0 10	1 1	0 2
Copper wire hemispherical gratings over outlets in eavesgutters to down pipes	,,	1 9	2 0	2 4	2 9	0 2
Galvanised iron wire ditto, ditto	,,	1 3	1 6	1 8	1 10	0 2
Strainers for heads of rainwater pipes	,,	0 2	0 3	0 4	0 6	0 2

Soil Pipes, &c.		Supplied only.	Add if Fixed.
		s. d.	s. d.
Down-pipes, heads, shoes, bends, gutters, &c., ogee or square moulded, other than foregoing, at	per lb.	0 2½	0 0½
4-in. soil-pipes, weighing 60 lb. per 6-ft. length, joints caulked with yarn and run with lead when fixed	per ft. run	1 6	0 5½
4-in. ventilating pipes, weighing 48 lb. per 6-ft. length, ditto	,,	1 3	0 5
Copper wire domical wire guards for ditto	each	2 6	0 3
Galvanised iron wire	,,	1 9	0 3
Ducksfoot bend for 4-in. soil-pipe, with baseplate 12 in. square, weighing 44 lb. each	,,	12 0	3 0
Branches for soil-pipe, single, weighing 24lb. each	,,	8 0	2 7
Branches for soil-pipe, double, weighing 34 lb. each	,,	11 6	4 3

		s. d.
Taking down gutters, pipes, &c., and remove to store	per ft. run	0 0½

Iron Founder—*continued.*

Weights.	3 in.	3½ in.	4 in.	5 in.
Half-round gutter, exclusive of brackets, &c., per 6 ft. length	lb. 9	lb. 11	lb. 13	lb. 17
Ogee gutter, ditto, ditto	13	14	16	20
Rainwater pipes, ditto, ditto	26	30	36	50

		s.	d.
5-in. by 4-in. cast-iron moulded eavesgutter, weighing 20 lb. per 6 ft. length, with plain faucet joints put together with screw-bolts and red-lead joints, and drilled for and fixed to deal fascia, with and including 1¼-in. stout screws, No. 3 to each 6-ft. length ...	per ft. run	1	0
Extra for stopped ends to ditto ...	each	0	9
,, internal or external angles ...	,,	1	6
,, outlets ...	,,	1	6
4-in. cast-iron stove-pipe, weighing 34 lb. per 6 ft. length, and jointing in red-lead, and passing into flue ...	per ft. run	1	3
Bends for ditto, weighing 14 lb. each, and fixing ...	each	3	6
Elbows with cleaning doors, 9½ lb. each, and fixing ...	,,	3	6
4-in. cast-iron main with spigot and socket joints, supplied only ...	per cwt.	13	0
Extra price for bends, tee-pieces, &c. ...	,,	6	6
Laying ditto, including clay, yarn, or gasket, sheet-lead, red-lead, or white-lead, and oil for joints, and making the joints and running with lead, and coating with Dr. Angus Smith's preparation	per yd. run	0	10
Laying bends, including two joints ...	each	2	0
,, tee-pieces, including three joints ...	,,	4	6
,, plugs and joint ...	,,	7	6
Cutting out length of pipe in existing 4-in. main ...	,,	4	0
Tapping 4-in. main for 1¼-in. pipe, and jointing with yarn and red-lead ...	,,	4	0
2-in. Brighton pattern hydrant, supplied only ...	,,	35	0
2-in. Brighton pattern stop-valve, supplied only ...	,,	40	0
4½-in. by 4-in. hydrant box, supplied only ...	,,	4	0
Fixing only 4-in. cast-iron sluice valves ...	,,	20	0
,, surface-boxes for ditto ...	,,	3	0
,, screw-down valve hydrants ...	,,	10	0
,, surface-boxes for ditto ...	,,	3	0
,, surface-boxes for 1¼-in. stopcocks ...	,,	2	0
Coating water-pipes, 4 in. to 6 in. dia., inside and outside, according to Dr. Angus Smith's process with heated coal-tar and linseed oil, and cleaning pipes ...	per yd. run	0	1¾
Ditto pipes 2 in. to 4 in. dia., ditto ...	,,	0	1¼
Ditto pipes under 2 in., ditto ...	,,	0	0½
Galvanising large articles 28 lb. and over ...	per cwt.	7	0
,, small articles under 28 lb. ...	,,	9	6

IRON FOUNDER—*continued.*

Holes in Pipes.	Internal Diameter of the Pipes.											
	½ in.		¾ in.		1 in.		1¼ in.		1½ in.		2 in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Drilling holes in pipes, &c., for connecting pipes, cocks, &c.....each	0	3½	0	4¼	0	4¾	0	5¼	0	6	0	7
Tapping ditto......... ,,	0	3½	0	4¼	0	4¾	0	5¼	0	6	0	7

Holes in Iron.		Depth of Hole not exceeding.									
		⅛ in.		¼ in.		½ in.		¾ in.		1 in.	
		s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Holes drilled and countersunk in iron, ¼ in. to ½ in. dia.	each	0	1	0	1½	0	2	0	3	0	4
Ditto, ⅝ in. to 1 in. dia. ...	,,	0	1½	0	2¼	0	3	0	4½	0	6
Add to the above if tapped, ¼ in. to ½ in. dia.	,,	0	1	0	1½	0	2	0	3	0	4
Ditto, ⅝ in. to 1 in. dia. ...	,,	0	1½	0	2¼	0	3	0	4½	0	6

If done in position, double the foregoing rates.

		s.	*d.*
Holes punched through sheet iron	each	0	0⅛
,, ,, and countersunk	,,	0	0¼
Cutting rounded corners or notches up to 3 in. girth in ¼-in. W. I. plates	,,	0	0½
Ditto in ½-in. plates	,,	0	1
Turning or boring wrought iron, brass, or gun-metal	per sq. in.	0	1
Ditto cast iron	,,	0	1½

STOVES AND RANGES.

		£	*s.*	*d.*
Gurney stove, size A, to warm room of 120,000 c. ft., and burning 10 lb. of fuel per hour, weighing 23 cwt. each	each	36	0	0
Ditto, size B, to warm room of 70,000 c. ft., and burning 9 lb. of fuel per hour, weighing 14 cwt. 3 qr. each	,,	25	0	0
Ditto, size C, to warm room of 30,000 c. ft., and burning 6 lb. of fuel per hour, weighing 8 cwt. 14 lb. each	,,	15	10	0
Galton's ventilating grate, 36 × 38 in., heats 2,500 c. ft.	,,	4	0	0
Self-acting "London" cottage range, oven and boiler, 36 in.	,,	1	8	6
Improved "London" kitchen range, oven and boiler, 48 in.	,,	5	0	0

Stoves and Ranges—*continued.*

		£	s.	d.
Extra strong "Leamington" range, oven and boiler, 60 in.	each	11	0	0
The "Self-setter" kitchen range, oven and boiler, 36 in.	,,	4	9	6
The "Housewife" stove, oven and boiler, 35 in. long, without utensils	,,	4	8	0

Trade discount for ranges and stoves 20 to 25 per cent. off foregoing.

Ventilators.

		s.	d.
Arnott's ventilators, bronzed or lacquered, small size	each	8	0
Ditto, ditto, large size	,,	11	0
Boyle's mica flap ventilators, plain iron, Size of front. Size of box.			
11 in. × 5 in. ... 9 in. × 3 in.	,,	4	0
11 in. × 7 in. ... 9 in. × 5¼ in.	,,	6	0
11 in. × 9 in. ... 9 in. × 7½ in.	,,	9	0
Boyle's latest patent "Air-Pump" soil-pipe ventilator, 8 in. dia. head, 4 in. dia. pipe, galvanised and painted, Design No. 225	,,	13	6
Ditto, ditto, cheap form, Design No. 227	,,	10	6
Boyle's latest patent "Air-Pump" ventilator, Design No. 175, 18 in. dia. head, 9 in. dia. pipe	,,	55	0
Ching's mica valve chimney-breast ventilators, plain iron, box size 9 in. × 3 in.	,,	4	0
Ditto, ditto, 9 in. × 7½ in.	,,	9	0
Ditto, ditto, 14 in. × 9 in.	,,	15	6
Ching's silent mica flap ventilators, with iron fronts, plain iron, box size 9 in. × 3 in.	,,	7	0
Ditto, ditto, 9 in. × 7½ in.	,,	14	0
Ditto, ditto, 14 in. × 9 in.	,,	25	0
Sheringham's ventilators, plain iron, box size 9 in. × 3 in.	,,	4	0
Ditto, ditto, 13½ in. × 6 in.	,,	7	0
Ditto, ditto, 9 in. × 6 in.	,,	5	0
Sanitary mica valve inlet ventilator, spigot, for 4-in. vent-pipe	,,	10	0
Iron wire guards for windows and sky-lights, lattice pattern, ¼-in. to ⅝-in. mesh, supplied only ...	per ft. sup.	0	8½
Add, if galvanised after manufacture...	,,	0	1½
Fly wire or wire gauze, under ⅛-in. mesh, supplied only	,,	1	1
Add to foregoing, if fixed	,,	0	2

Cisterns.

		£	s.	d.
Galvanised wrought-iron square cisterns, 14 W.G., 20 gal.	each	1	2	0
Ditto, ditto, 50 gal.	,,	1	14	0
Ditto, ditto, 100 gal.	,,	2	14	0
Ditto, ditto, 150 gal.	,,	3	11	0
Ditto, ditto, 200 gal.	,,	4	10	0
Ditto, ditto, 250 gal.	,,	5	10	0

CISTERNS—*continued.*

		£	s.	d.
C. Winn & Co.'s galv. wrought-iron square cisterns, 300 gal.	each	6	0	0
Iron sliding door, 7 ft. by 4 ft., with $\frac{1}{4}$-in. plates, stiles and rails, $\frac{3}{8}$ in. thick, guide, channel runner bar, hangers, cast-iron bored wheels, steel pins, handle, hasp, &c.	,,	7	0	0

IRON ROOFS.

These may be had complete, as Fig. 41, for spans of 15 ft. to 25 ft. as follows :—

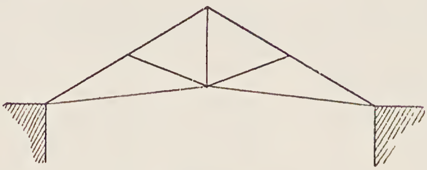

FIG. 41.

Span.	T-Rafters.	T-Struts.	Ties.		Price complete.
					£ s. d.
15 ft.	$2 \times 2 \times \frac{1}{4}$	$2 \times 2 \times \frac{1}{4}$	$\frac{3}{4}$	$\frac{5}{8}$	2 10 0
20 ,,	$2 \times 2 \times \frac{3}{8}$	$2 \times 2 \times \frac{1}{4}$	$\frac{7}{8}$	$\frac{3}{4}$	3 5 0
25 ,,	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	$2 \times 2 \times \frac{1}{4}$	1	$\frac{7}{8}$	3 17 6

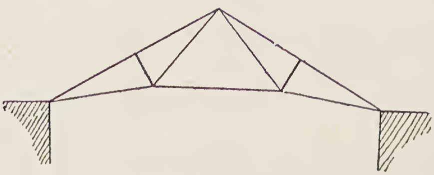

FIG. 42.

Ditto, as Fig. 42, for spans of 20 ft. to 30 ft. :—

Span.	T-Rafters.	T-Struts.	Tie Rods.			Price complete.
						£ s. d.
20 ft.	$2 \times 2 \times \frac{1}{4}$	$2 \times 2 \times \frac{1}{4}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{3}{4}$	3 10 0
25 ,,	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	1	$\frac{7}{8}$	$\frac{7}{8}$	4 4 0
30 ,,	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{3}{8}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \frac{5}{16}$	$1\frac{1}{4}$	1	$\frac{7}{8}$	4 18 0

For light galvanised sheds, buildings, and roofs, where cheapness is requisite, roofs can be erected at a cost from 10*d.* to 1*s.* 3*d.* per foot of space covered.

Coppersmith.

		s.	d.
Wrought copper in ties and cramps, supplied only...	per lb.	1	6
Add if fixed	,,	0	2
Brass or gunmetal castings, supplied only	,,	1	2
Add if fixed	,,	0	2
Add if drilled and fitted complete	,,	0	4
Sheet copper to roofs, &c., including copper nails for fixing, supplied only	,,	1	2
Add if fixed	,,	0	3
Welded edge or seam	per ft. run	0	4
Copper in sheathing, 12 oz. per foot super., including seams, laps, copper ties, nails, fixed and labour	per ft. sup.	1	4
Ditto, 16 oz., ditto, ditto	,,	1	7
Ditto, 18 oz., ditto, ditto	,,	1	9
Taking up, redressing, and relaying copper sheathing, any weight	,,	0	4½
1-in. by $\frac{1}{16}$-in. copper tape lightning conductor, weighing 24 lb. per foot	per lb.	0	8
1-in. and 1½-in. gunmetal holdfasts for ditto ...	,,	1	0

Bellhanger.

		s.	d.
House bells of:			
1 part tin and 4 parts copper	per lb.	1	6
1 ,, 3 ,, 3 in.	each	0	11
1 ,, 3 ,, 3½ in.	,,	1	4
1 ,, 3 ,, 4 in.	,,	2	3
Add if with springs, carriages, and pendulum ...	,,	2	3
Common brass cranks for bells, supplied only ...	,,	0	3
Add if fixed	,,	0	2
Ditto, mounted pillar or T-plate, single or double, supplied only	,,	0	9
Add if fixed	,,	0	4
Bronzed bell-pulls, outside, with sunk handle, supplied only	,,	5	0
Add if fixed	,,	1	0
Brass bell-pulls, outside, with sunk handle, supplied only	,,	1	9
Add if fixed	,,	0	9
Ditto lever, with white knob, supplied only ...	,,	4	0
Add if fixed	,,	0	6
Galvanised bell staples	per doz.	0	3
Bells hung complete in secret zinc tubing, with best mounted cranks, copper wire, check springs, staples, and labour, excepting the bell, spring, and carriage, pull and rope—on same floor ...	per pull	11	6
Ditto, ditto, one storey...	,,	13	6
Ditto, ditto, two stories	,,	14	6
Ditto, ditto, three stories	,,	16	6
Electric bells, fixed complete	,,	20	0

Bellhanger—*continued.*

		s.	d.
1-in. flexible speaking tube, worsted cover	per ft. run	1	7
1-in. zinc speaking tube, with socket joints, and fixed	,,	0	5
$\frac{1}{2}$-in. zinc bell tube, and fixed	,,	0	2
Extra for circular elbows	each	0	9
Connecting screws	,,	1	4
Ivory mouthpiece, with whistle	,,	6	0
Ebonite ,, ,, ,,	,,	3	0

Materials.

(supplied only.)

		s.	d.
Ashes, coal, sifted	per bushel	0	3
,, forge, smith's	,,	0	$3\frac{1}{2}$
Asbestos, ordinary millboard	per lb.	1	0
,, rubber woven sheeting	,,	3	6
,, composition, No. 1 quality, dry	per cwt.	25	0
Borings, iron	,,	6	0
Breeze or coal dust	,,	1	0
Borax, lump	per lb.	0	3
,, powdered	,,	0	$3\frac{1}{2}$
Brass, sheet, Nos. 16, 18, or 20 gauge	,,	1	0
Cement, iron	,,	0	6
,, red-lead	,,	0	3
Coal for forges, smith's	per ton	20	0
,, Newcastle, or other of equal quality	,,	24	0
Coke, gas, large	per bushel	0	8
Emery powder, fine or coarse	per lb.	0	3
Gasket	,,	0	3
Indiarubber, vulcanised, for flanges, washers, &c.	,,	5	0
Lead for running	,,	0	2
White-lead ground in oil	,,	0	$3\frac{1}{2}$
Oakum, white or tarred	,,	0	$3\frac{1}{4}$
Oil, paraffin or kerosene	per gal.	0	9
,, neatsfoot	,,	4	0
,, olive or sweet	,,	5	0
,, Rangoon, for machinery	,,	2	0
Glass, or emery cloth	per quire	0	10
Glass paper, sand, or emery	,,	0	10
Rivets, best wrought iron, 8 to 24 lb. per 1,000	per lb.	0	5
,, galvanised ,, ,,	,,	0	7
,, copper	,,	1	6
Roofing galv. corrugated W.I. sheets, No. 18 S.W.G., with 5-in. corrugations $1\frac{1}{4}$ in. deep, supplied only, 6 ft. by 2 ft. 9 in.	each	5	4
Ditto, ditto, 6 ft. 6 in. by 2 ft. 9 in.	,,	5	9
Ditto, ditto, 7 ft. by 2 ft. 9 in.	,,	6	3
Rivets and washers, $\frac{1}{4}$ in. dia., for ditto	per lb.	0	4
Galvanised W.I. screws, 3 in. long, with washers and round heads	per doz.	0	6
Galvanised hook bolts, 4 in. long	per gross	12	0
,, iron ridge capping, 18-in. girth, 20 B.W.G., in 6 ft. lengths	per ft. run	0	6
Spelter, brass, yellow	per lb.	1	0
,, copper, yellow	,,	1	0
,, zinc	,,	0	6

MATERIALS—*continued.*

			s.	d.
Staples, round, 1½ in. long and under	... ...	per doz.	0	3
,, ,, 1¾ in. to 2½ in. long ...	... ...	,,	0	4½
Varnish, imperial, for ironwork	... ...	per gal.	5	6
Waste, cotton	... ...	per lb.	0	2
Wire, brass	... ...	,,	1	2
,, copper	... ...	,,	1	2
,, galvanised iron, 1 to 9 S.W.G....	... ...	per cwt.	12	6
,, ,, ,, 10 to 17 S.W.G.	... ...	,,	16	8
,, ,, ,, 18 to 19 S.W.G.	... ...	,,	20	0
,, netting, galvanised iron, 1-in. to 1½-in. mesh		per yd. sup.	0	5
Wick, cotton, for lamps	... ...	per lb.	1	0
Yarn, spun or rope	... ...	,,	0	3
Wages, smith's ...	... ...	per hour	0	10½
,, ,, labourer	... ...	,,	0	7
,, bellhanger's	... ...	,,	0	10½

ANALYSIS.

The elementary differences between wrought iron, steel, and cast iron are :—

Wrought iron contains little or no carbon, not exceeding 0·25 per cent.
Steel contains a small percentage, from 0·15 to 1·8 per cent.
Cast iron contains a large percentage, from 2·0 to 6·0 per cent.

Wrought-iron articles are usually specified to be manufactured from iron equal in quality to best Staffordshire, and approved by the architect before fixing : to be forged clean from the anvil, and neatly, soundly, and perfectly finished.

Steel is now generally substituted for rolled iron, especially in joists, on account of the greater strength embodied in smaller size, and being more serviceable in every way. Also, being little more in cost, it is obviously more economical to employ than wrought iron. The most reliable process for the production of steel of a high-class uniform quality is the Siemens-Martin open-hearth acid process.

Cast Iron is divided into "grey" and "white." The former is made from foundry pigs containing a large proportion of free carbon—the latter from forge pigs, which contain very little free carbon. A mixture of grey and white is called "mottled" cast iron. The usual description is that cast-iron articles are to be of good soft grey iron from the second melting (and not run direct from the blast furnace) cast sound and clean, and subject to such tests as may be made by the architect.

Coals of best quality for smith's work come from Wales, the small stuff or screenings being used. It is hard and anthracitic, but gives out great heat. A sulphurous coal injures the quality of the iron.

Sizes usually Manufactured.

Bar Iron, round or square. Bars under $\frac{5}{8}$ in. diameter are classed as rods, and under $\frac{3}{16}$ in. as wire :—

Side or diameter	$\frac{5}{8}$ in. to 3 in.
Length	20 ft. to 30 ft.

Bar Iron, flat :

Section	1 in. by $\frac{1}{4}$ in. to 6 in. by 2 in.
Length	Up to 20 ft.

Angle and T-*Iron* can be obtained in lengths from 20 ft. to 30 ft. long, and up to 12 in. by 3 in. by $\frac{3}{4}$ in. in section.

R.I. Girders are rolled up to 16 in. deep and 30 ft. in length.

Plates.—Any thickness from $\frac{1}{8}$ in. to 1 in., less than $\frac{3}{16}$ in. being classed as sheets. Plates may be generally obtained up to 4 ft. wide, 15 ft. long, or 30 ft. super.; and sheets up to 3 ft. wide and 8 ft. long, or 24 ft. super.

Steel.—The following is a table of the ordinary sizes to which steel can be rolled without extra charge :—

Dimensions.	Flat Bars.	Round and Square.	Angle.	Tee.	Channel and Joist.
Length, feet	40	24	50	50	36
Width, inches	18	4	6 × 6	5 × 3	12
Thickness, inches	1	—	$\frac{7}{8}$	$\frac{3}{8}$	—

A great variety of other forms can also be obtained in iron and steel.

Basis of Pricing.

The basis of all pricing of smith and founder's work is generally the weight of the article, and when this is ascertained the comparative values of the labour on each are easily adjusted. It is essential to obtain prices for all ironwork direct from the founder or smith when there is any quantity, as the market fluctuates a good deal. The various qualities likewise cause great differences in cost. The price of good ordinary iron in England is about 1*d*. per lb.; and the cost of the Farnley brand of best Yorkshire is 2*d*. per lb. The latter,

U 2

being tough and ductile, allows of greater facility in working, and so proves cheaper in the end for superior work.

Although ironwork generally is billed at per weight, small articles are quoted by number, and such articles as pipes and gutters by the foot run. Where patterns are plain they are often in stock, and are then included in the price quoted, which should be "delivered on site." Prices for London castings will be 1*s*. to 1*s*. 6*d*. per cwt. more than country castings. Rolled iron joists are billed at per cwt., but small joists (up to 9 in. deep) and large joists should be kept separate, and it should be stated whether hoisting is included or taken separately. Add 5 per cent. of the total weight of riveted girders for weight of rivets at the usual 4-in. pitch.

Average Market Prices.

	Per ton.				Per cwt.				Per lb.
	£	*s.*	*d.*		£	*s.*	*d.*		*d.*
Rolled Iron Joists, Belgian	5	15	0	=	0	5	9	=	0¾
Rolled Steel Joists, English	6	12	6	=	0	6	8	=	0¾
Wrought-iron Girder-plates	7	0	0	=	0	7	0	=	0¾
Bar-Iron, good Staffordshire	8	0	0	=	0	8	0	=	0¾
,, Lowmoor, flat, round, or square	20	0	0	=	1	0	0	=	2¼
,, Welsh	5	17	0	=	0	5	10	=	0½
Boiler Plates, iron, Staffordshire	8	15	0	=	0	8	9	=	1
Angle-iron, 10*s*. per ton extra	0	10	0	=	0	0	6	=	0¼
Tee-iron, 20*s*. ditto	1	0	0	=	0	1	0	=	0¼
Galv. corrugated sheet iron	12	0	0	=	0	12	0	=	1¼
Pig-iron, cold blast	5	10	0	=	0	5	6	=	0½
,, hot blast	3	8	0	=	0	3	5	=	0½
Cast-iron columns	7	10	0	=	0	7	6	=	1
,, stanchions	7	10	0	=	0	7	6	=	1
,, sash weights	4	12	6	=	0	4	8	=	0½
,, socket-pipes, 3 in.	6	0	0	=	0	6	0	=	0¾
,, ,, 4 in. to 6 in. ...	5	15	0	=	0	5	9	=	0¾
,, ,, 7 in. to 24 in. ...	5	8	0	=	0	5	5	=	0¾
Coated with composition, extra	0	5	0	=	0	0	3	=	0
Turned and bored joints, extra	0	5	0	=	0	0	3	=	0
Copper sheets and rods	75	0	0	=	3	15	0	=	8
Copper, British ingot	62	0	0	=	3	2	0	=	6¾

General Notes on Cost.

English rolled steel joists cost about £6 12*s*. 6*d*. per ton. Belgian rolled joists are cheaper, or £5 15*s*. per ton.

Sawing ends square to required length, while hot, is included in the price. A cutting margin of 1 in. under or over specification is claimed as fulfilling this condition.

Cutting to "exact length"—*i.e.*, ⅛ in. or ¼ in. under or over specified length, is charged 3*s*. per ton extra.

Cutting cold to "dead length," or perfectly true, 5*s*. to 7*s*. 6*d*. per ton extra. Facing square is extra.

Joists or girders above 36 ft. in length, 1*s*. 6*d*. per ton per foot extra.

For quantities under 5 tons, and for delivery within three weeks, 5*s*. per ton extra.

For delivery from stock promptly, for quantities above 5 tons, 10*s*. per ton extra.

For delivery from stock promptly, for quantities below 5 tons, 15*s*. per ton extra.

Round holes in flanges, 2*d*., in webs 1*d*. each.

Oval holes in flanges, 3*d*., in webs 2*d*. each.

Unless otherwise specified, all the holes in girders and for connections will be punched; an extra is charged for drilled work.

Cold straightening when required is charged as an extra.

Special quotations can be obtained for girders of the best iron or mild steel.

Items of Work.

The analysis of ironwork is simple, and, being alike for most items, only a few cases need be taken. It is mostly a matter of the cost of the iron by weight and fixing.

Wrought Iron in Chimney, Bearing Bars, &c., and Fixed.—Good Staffordshire bar iron costs £8 per ton, or 8*s*. per cwt. For conversion allow 8 hours of smith per cwt.

		s.	*d*.
1 cwt. wrought-iron bar		8	0
Labour converting, 8 hours smith at 10½*d*.		7	0
Fixing, or cartage, 1 hour bricklayer at 10½*d*.		0	10½
		15	10½
Add 15 per cent. profit		2	4½
Price per cwt.	112)	18	3
Price per lb.		0	2

For large quantities iron is billed at per cwt.; but when in small amounts at per lb., the price will be relatively higher.

A smith will make in a day of ten hours a set of irons for a king-post roof-truss—viz., 2 heel-straps, 1 set of crown irons, 1 stirrup-strap, with bolts, gibs, and keys, &c., weighing 50 lb. total, or 5 lb. per hour.

Wrought Iron in Bars and Rails for Windows, and Fixed.—A better quality of iron would here be used at £10 per ton, or 10*s*. per cwt., and there would be more labour.

	s.	d.
1 cwt. wrought-iron bar	10	0
Labour converting, 12 hours smith at $10\frac{1}{2}d.$	10	6
Fixing in position, 2 hours bricklayer at $10\frac{1}{2}d.$	1	9
	22	3
Add 15 per cent. profit	3	4
Price per cwt.	112)25	7
Price per lb.	0	$2\frac{3}{4}$

For pointing ends of $\frac{3}{4}$-in. bars, reckon $\frac{1}{4}$ hour smith at $10\frac{1}{2}d. = 2\frac{1}{2}d.$, plus $1d.$ for fire, files, and profit, or $3\frac{1}{2}d.$ each, total.

Bolts, Screw, prepared with Heads, Nuts, and Washers, and Fixed.—These may be bought locally, ready made, for $6d.$ each if, say, $\frac{3}{4}$ in. × 12 in. in size. By weight the cost would be $22s.$ per cwt., or $2\frac{1}{4}d.$ per pound, for the iron supplied only, and prior to conversion.

Rolled Steel Joists, Cut to Length, and Fixed.—The cost of these would be made up somewhat as follows :—

	s.	d.
1 cwt. R. S. joists at £6 $12s.$ $6d.$ per ton	5	9
Cutting to "exact length" at $3s.$ per ton, per cwt.	0	2
For quantities under 5 tons at $5s.$,, ,, ...	0	3
For delivery promptly at $15s.$,, ,, ...	0	9
Carriage and delivery, say	2	0
Fixing, 2 hours smith at $10\frac{1}{2}d.$	1	9
	10	8
Add 15 per cent. profit	1	7
Price per cwt....	12	3

Corrugated Iron Roofing.—This is billed at per cwt., or more conveniently at per square, fixed complete, including rivets or screws and washers. For the area of roofs, measure the surface and add one-fourth for laps, or only one-sixth if not corrugated. The sheets are 6 ft. to 8 ft. long, and 2 ft. to 3 ft. wide, the usual gauges for roofs being Nos. 18 or 20. They should overlap about 6 in., be riveted 9 in. apart, and double riveted at the cross-joints. A side intersection of two corrugations should be given, which are 3 in. to 6 in. apart from centre to centre, and $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. in depth. From $2\frac{1}{2}$ lb. to $3\frac{1}{2}$ lb. of rivets are required for a square of roofing. One-third added to the weight of the sheets measured on the flat will give approximately the weight of the corrugated

sheets, including laps. Galvanising sheet iron adds to the weight ·096 lb. per foot super. for each side.

Iron Pipes.—Iron pipes can be bought from any first-class London firm as satisfactorily as from the manufacturers. There are three qualities: ordinary, steam, and water. It is the custom with builders of good credit or ready money to write to two or three good firms for a quotation, giving quantity. In some things there is 20 per cent., and more, difference in these quotations. Pipes 2 in. diameter and under are generally specified to be wrought-iron lap-welded or butt-welded galvanised tubing, connected with screwed sockets of strong make, and capable of standing a hydraulic pressure of 400 ft. head of water, and to have all requisite fittings, such as bends, elbows, tees, sockets, &c., as may be required. The whole to be put together with red-lead cement, and to be properly screwed. Equal proportions of red- and white-lead, mixed with linseed oil, make a good cement for joints in ironwork. All connections to cisterns and boilers to be made with brass screw unions and fly nuts. The fixing of pipes provides work for the fitter and his mate, and the last-named operative must not be overlooked.

Discount off standard lists for wrought-iron tubes and fittings:—

Gas-tubes	67½	per cent.
Water-tubes	62½	,,
Steam-tubes	57½	,,
Galvanised gas-tubes	55	,,
Galvanised water-tubes	50	,,
Galvanised steam-tubes	45	,,

Cast-iron water-pipes should be specified to be cast vertically, and to be proved to 600 ft. head of water pressure (although 300 ft. is sometimes deemed sufficient); the contractor to produce the manufacturer's certificate of such test. For laying and jointing the contractor will have to provide the necessary firing, tempered clay, yarn or gasket, lead, tools, and appliances. Cast-iron pipes ought to be coated with Dr. Angus Smith's solution.

Rust Joints.—Iron cement, or rust-joint cement, for iron pipes, is made up (by weight) as follows:—

Quick-setting: 80 to 100 parts of iron borings or iron filings pounded fine, 1 powdered sal-ammoniac, and 2 powdered or flour sulphur. Mix thoroughly, and bring to a paste with water. This should be done one to two hours before required, and the paste must be used up the same day as it is made, or it will become prematurely hard.

Slow-setting: 200 parts iron borings, 9 sal-ammoniac, 1 flour sulphur, all powdered and mixed as before. This makes a better joint than the first. "Swarf" is another name for iron borings or iron filings.

3-*in. Rainwater Pipe, and Fixed.*—Cast-iron down pipes are sold in 6-ft. lengths at per yard run for price, but are billed at per foot run. This sized pipe weighs 26 lb. per 6-ft. length, equivalent to 4½ lb. per foot run at 1*d.* per lb. Oil cement for joints. The analysis would be taken per 6 ft. length.

	s.	*d.*
6 ft. 3 in. R.W. pipe, at 1*s.* 3*d.* per yard	2	6
Two holdfasts (or lugs) at 2*s.* per dozen	0	4
Four nails for last, at 6*d.* per dozen	0	2
Red- and white-lead for joints	0	2
Labour fixing, ½ hour smith at 10½*d.*	0	5¼
	3	7¼
Add 15 per cent. profit	0	6¾
	6)4	2
Price of per foot run	0	8

To prevent leakage and damp walls down-pipes should be blocked off from the wall about 1 in.

Add Extra to last for Swan-neck, 6-in. Projection, and Fixed.—As this is extra only for the cost of the bend over that of the price for straight, the detail is slight. Care must be taken, however, to reckon the cost of the swan-neck in length compared with that of a foot of straight piping. In this instance, a swan-neck, with 6-in. projection, would have 3 in. above and below in addition, or 1 ft. of total length.

	s.	*d.*
Cost of 3 in. swan-neck, 6-in. projection	1	6
Deduct cost of 1 ft. of straight piping	0	7
	0	11
Extra labour in fixing, say	0	3
	1	2
Add profit	0	2
Price of each, extra only	1	4

Bends, shoes, &c., are similarly treated.

Hopper Head, flat, to 3-in. Pipe, and Fixed.—The design and cost vary, but a passable head costs :—

	s.	d.
Hopper head, flat	2	3
Nails and fixing	0	4
	2	7
Add profit	0	5
Price of each...	3	0

5-*in. Half-round Eaves Gutter, and Fixed.*—These are likewise sold in 6-ft. lengths at per yard run for price, and billed at per foot run. The gutters have plain faucet joints, put together with screw bolts and nuts and red-lead; and supported per 6-ft. length by two brackets, or fastened to fascia with three 1¼-in. stout screws, including drilling and countersinking in iron for ditto. The latter method, however, is for moulded gutters, with a vertical side. The analysis is also similar to rainwater pipes.

	s.	d.
6 ft. 5-in. half-round gutter at 11*d.* per yard	1	10
2 brackets at 3*s.* per dozen	0	6
Gutter bolts and red-lead cement	0	4½
Labour fixing, 1 hour smith at 10½*d.*	0	10½
	3	7
Add 15 per cent. profit	0	6½
	6)4	1½
Price per foot run	0	8¼

Add Extra to last for Angles.—Take an angle as 6 in. each way, or 1 ft. total length round. Then as swan-necks :—

	s.	d.
Cost of angle for 5-in. H.R. gutter	1	1½
Deduct cost of 1 ft. of guttering	0	8¼
	0	5¼
Extra fixing and bolts, &c.	0	6
	0	11¼
Add profit	0	1¾
Price of each, extra only	1	1

Add Extra for Nozzles or Outlets.—The nozzle is cast on to a small piece of guttering 1 ft. long. Therefore—

	s.	d.
Cost of nozzle length of 5-in. guttering	1	$1\frac{1}{2}$
Deduct cost of 1 ft. of guttering	0	$8\frac{1}{4}$
	0	$5\frac{1}{4}$
Extra fixing, and bolts, &c.	0	6
	0	$11\frac{1}{4}$
Add profit	0	$1\frac{3}{4}$
Price of each, extra only	1	1

Caulking Tank.—It takes two men four days of $10\frac{1}{2}$ hours = 84 hours, to caulk a 5,000 gal. cast-iron octagonal tank, supplied by Messrs. Douglass, Blaydon-on-Tyne. Each tank comprises nine bottom-plates, and 16 side-plates in two heights, of $\frac{5}{8}$-in. metal, the total standing 7 ft. high and 12 ft. across. The weight of the tank complete is 12,050 lb., and it is supported on a brick or concrete base. To form the rust-joints, 4 cwt. of swarf (iron filings), sal-ammoniac, and sulphur are required, also 160 lb. of screwed bolts and nuts.

CHAPTER XV.—PLUMBER AND ZINCWORKER.

MEMORANDA.

Weights and Thicknesses of Sheet Lead.

Weight in pounds per foot super.	Thickness in inches.	Nearest simple fraction.	Weight in pounds per foot super.	Thickness in inches.	Nearest simple fraction.
1	0·017	$\frac{1}{60}$	8	0·135	$\frac{1}{8}$
2	0·034	$\frac{1}{32}$	9	0·152	$\frac{9}{64}$
3	0·051	$\frac{1}{20}$	10	0·169	$\frac{5}{32}$
4	0·068	$\frac{1}{16}$	11	0·186	$\frac{11}{64}$
5	0·085	$\frac{5}{64}$	12	0·203	$\frac{3}{16}$
6	0·101	$\frac{3}{32}$	15	0·255	$\frac{1}{4}$
7	0·118	$\frac{7}{64}$	59	1·000	—

Milled lead is rolled in sheets 20 ft. to 35 ft. long, and 6 ft. to 9 ft. wide, and is made from 1 lb. to 12 lb. weight per foot super.

Cast lead is made in sheets about 6 ft. wide and 16 ft. or 18 ft. long.

Weight of Lead Soil and Waste Pipes per 10 ft. Length.

Internal Diameter.	6 lb. Lead.	7 lb. Lead.	8 lb. Lead.
in.	lb.	lb.	lb.
$2\frac{1}{2}$	41	48	55
3	49	57	66
$3\frac{1}{2}$	57	67	76
4	65	76	87
5	80	94	107
6	94	112	128

These weights are 2 lb. above those allowed in the London County Council By-Laws.

METROPOLITAN WEIGHTS AND THICKNESS OF DRAWN LEAD PIPES PER YARD RUN :—

Internal Diameter.	Middling.		Strong.	
	Thickness.	Weight.	Thickness.	Weight.
in.	in.	lb.	in.	lb.
$\frac{1}{2}$	·14	4	·19	6
$\frac{3}{4}$	·15	6	·20	9
1	·16	9	·21	12
$1\frac{1}{4}$	·18	12	·23	16
$1\frac{1}{2}$	·19	16	·22	19
2	·20	21	·23	24

Lead pipes up to 1 in. diam. are made in coils of 60 ft. long.
,, $1\frac{1}{4}$ to 2 in. ,, ,, ,, 36 ft. ,,
,, $2\frac{1}{4}$ to 6 in. ,, ,, lengths of 10 ft.

SOLDER REQUIRED FOR JOINTS.

A wiped soldered joint for $\frac{1}{2}$ in. pipe requires $\frac{3}{4}$ lb. of solder.
,, ,, $\frac{3}{4}$ in. ,, 1 lb. ,,
,, ,, 1 in. ,, $1\frac{1}{4}$ lb. ,,
,, ,, $1\frac{1}{4}$ in. ,, $1\frac{1}{2}$ lb. ,,
,, ,, $1\frac{1}{2}$ in. ,, $1\frac{3}{4}$ lb. ,,
,, ,, 2 in. ,, $2\frac{1}{4}$ lb. ,,
,, ,, $2\frac{1}{2}$ in. ,, $2\frac{3}{4}$ lb. ,,

Expansion of lead by heat = 1 ft. in 349.

AVERAGE WEIGHT OF A FULL-SIZE PLUNGE BATH.

Description of Material.	Weight.
Sheet copper	76 lb.
Enamelled cast-iron	300 lb.
Slate	500 lb.
Porcelain	500 lb.
Marble	600 lb.

ZINC.

Zinc for roofing purposes is rolled in sheets 7 ft. long by 3 ft. wide. It may be rolled of any additional length under 10 ft. at an extra cost. The gauges for zinc roofing are Nos. 14, 15, and 16.

Equivalent gauges and weights per square foot, Vieille Montagne Co.:—

Zinc Gauge.		B.W.G.		Weight per Square Foot.
14	...	21	...	18¾ oz.
15	...	20	...	21¾ oz.
16	...	19	...	24¾ oz.

Approximate weight per square, including corrugations and laps:—

Description.	14 Gauge.	15 Gauge.	16 Gauge.
Square roll cap	144 lb.	169 lb.	192 lb.
"Italian" corrugation ...	150 lb.	175 lb.	198 lb.

PRICES.

Lead Work.

		s.	d.
Milled sheet lead, supplied only	per cwt.	16	6
Recasting and remilling old lead, or exchanging new lead for old, 4 lb. to 6 lb. being allowed per cwt. for waste and dirt	,,	5	6
Add to two last items if cut to dimensions required	,,	1	6
Labour and nails in laying or fixing, dressing, and bossing up lead, exclusive of soldered joints and tacks	,,	5	6
Milled lead and laying in gutters and flats, &c. ...	,,	24	0
,, ,, flashings to parapets ...	,,	25	4
Sheet lead taken up and removed to store	,,	1	6
Close iron nailing, 1 in. apart, to lead or zinc ...	per ft. run	0	2
,, zinc ,, ,, ,, ...	,,	0	2½
,, copper ,, ,, ,, ...	,,	0	3½
For open nailing deduct 50 per cent. from foregoing			
Soldering joints (1 lb. to 1½ lb. of solder per foot), labour and materials	,,	1	6
Flashings, bedding in white-lead (labour and white-lead)	,,	0	1½
Running, in lead in masonry (including lead and fuel)	,,	0	9
Wedging flashing with lead	,,	0	3
Labour to welt	,,	0	2
,, double	,,	0	3½
Dressing to 1½ in. rounded edges	,,	0	2
Soldered seam	,,	1	2
,, angle	,,	1	0
Extra labour and solder to cesspool	each	3	6
Soldered tacks or dots, including screws	,,	0	7
Bossed ends to rolls	,,	0	6
Intersection of two rolls	,,	0	9

Lead Pipes.

Patent or drawn pipe, 2 in. and under	per cwt.	17	6
,, ,, above 2 in.	,,	20	6
Soldered sweep pipes and bends	,,	37	6
Haines' patent lead encased block-tin pipe	,,	53	0
Fixing pipes, including holdfasts, but exclusive of soldered joints...	,,	5	0

Lead Pipes—*continued.*

Description.	Materials, Labour, and Fixing.	Labour only.
	s. d.	s. d.
½-in. lead pipe, middling ....per ft. run	0 7	0 2
¾-in. ,, ,, ... ,,	0 9	0 3
1-in. ,, ,, ... ,,	1 4	0 4
1¼-in. ,, ,, ... ,,	1 6	0 4½
1½-in. ,, ,, ... ,,	1 9	0 5
2-in. ,, ,, ... ,,	2 6	0 6
2½-in. ,, ,, ... ,,	3 0	0 7
3-in. ,, ,, ... ,,	3 6	0 8

		s. d.
Add for bends in drawn lead pipes, ½ in. to 1 in. diam.	each	0 8
,, ,, ,, 1 in. to 2½ in. ,,	,,	1 0
,, ,, ,, 2½ in. to 3½ in. ,,	,,	2 3
,, ,, ,, 3½ in. to 4 in. ,,	,,	4 0
Soldering joints of lead pipes, including labour, solder, and fire, ¾-in. pipe	,,	1 0
Ditto, ditto, 1-in. pipe	,,	1 3
Ditto, ditto, 1½-in. ,, ...	,,	2 4
Ditto, ditto, 2-in. ,, ...	,,	3 3
Soldered ends to ¾-in. pipe	,,	0 6
Old lead pipe taken up and removed, exclusive of digging	per lb.	0 0¼
Covering pipes up to 2 in. diam. with two thicknesses of hair felt, bound on with tarred twine	per yd. run	0 6
Leaded joints in 4-in. cast-iron socket soil-pipes, including lead, gasket, fuel, and all labour ...	each	1 2
4-in. soil-pipe of 7 lb. lead, with collars, joints, and fixing	per ft. run	3 0
Extra for bends in ditto	each	3 2
Extra soldered joints in ditto	,,	3 6
Boyle's air-pump ventilator, 8 in. diam., No. 227, for 4-in. soil-pipe, and fixing	,,	16 3
Connection of soil-pipe with drain	,,	4 7

Lead Traps.

Description.	1½ in.	2 in.	2½ in.	3 in.	4 in.
	s. d.	s. d.	s. d.	s. d.	s. d.
Drawn lead traps, P or S, 8 lb. lead, s.o. .... each	2 2	3 9	5 6	7 3	9 6
Ditto, with brass screw plug... ,,	3 0	4 6	6 3	8 0	—
Add if fixed, including one soldered joint .... ,,	2 6	3 8	5 1	5 4	5 9

Brass Valves, Washers, Wastes, &c.

Description.		¾ in.	1 in.	1¼ in.	1½ in.	2 in.
		s. d.	s. d.	s. d.	s. d.	s. d.
Round closet valves, with screws, nuts, and unions...	each	—	—	6 3	—	—
Washers and wastes for lead cisterns	,,	1 0	1 7	2 1	2 6	4 2
Ditto with screws or nuts for iron or slate cisterns, screwed for iron pipe....................	,,	2 8	4 0	5 0	6 10	11 0
Ditto with unions for slate cisterns	,,	2 7	4 1	5 3	6 10	10 2
Add to foregoing if fixed, including soldered joint	,,	1 6	1 9	2 1	3 1	3 9
Brass plugs only to wastes, and fixing........................	,,	1 8	1 10	2 0	2 3	3 0
Pantry washers and wastes, with chains and gratings ...	,,	1 0	1 3	1 6	1 8	2 2
Add if fixed, including soldered joint to waste	,,	1 6	1 9	2 1	3 0	3 7
Soldering-in brass gratings ...	,,	0 4	0 5	0 6	0 7	0 8

Brass Cocks, &c.

Description.		½ in.	¾ in.	1 in.	1¼ in.	1½ in.
		s. d.	s. d.	s. d.	s. d.	s. d.
Screw-down brass bib-cocks, supplied only	each	3 0	4 0	6 0	13 0	19 0
Screw-down gunmetal stop-cocks, supplied only	,,	3 4	5 2	7 0	15 0	21 0
High-pressure horizontal ball valve, including copper ball and rod complete	,,	3 2	4 5	6 1	12 3	18 2
Self-closing bib-cock of approved pattern..............	,,	7 0	12 0	15 6	—	—
Tylor's "The Waste-not" bib-tap	,,	5 3	8 3	12 8	—	—
Add to the above if with screwed end..................	,,	0 3	0 6	0 9	1 3	1 8
Ditto if with fly-nuts, as for boilers, slate cisterns, &c.	,,	0 9	1 0	1 9	2 9	4 3
Ditto if with W.I. galv. lever handles	,,	0 8	0 10	1 3	1 6	2 0
Fixing cocks and valves, including washers, &c.	,,	0 5	0 5	0 6	0 7	0 8
Ditto bib-cocks and valves with one soldered joint...	,,	0 11	1 2	1 5½	1 11	2 6
Ditto with two soldered joints..........................	,,	1 10	2 5	3 0	3 10	5 0
Easing, regulating, and adjusting cocks or valves ...	,,	0 9	0 10	1 2	1 6	2 0

BRASS COCKS, &c.—*continued.*

Description.	½ in.	¾ in.	1 in.	1¼ in.	1½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.
Ferrules, straight or elbow, with ground union joint each	1 0	1 6	2 2	—	—
Ditto, ditto, screwed for iron ,,	0 8	1 2	1 6	—	—
Add to two last if fixed...... ,,	0 3	0 3½	0 4	0 4¾	0 5½
Union joints for iron pipes ,,	0 10	1 6	1 9	3 3	4 3
Ditto if fixed .... ,,	1 5	2 3	2 8	4 4	5 5
Union joints for lead pipes ,,	1 0	1 9	2 6	4 0	5 0
Ditto if fixed, including soldered joints .... ,,	2 7	3 9	4 11	7 4	9 10
Brass screw union with fly-nut for iron, and joint to lead pipe .... ,,	2 6	3 5	4 0	4 9	5 6

Connection with Water Company's main, say 23*s.*

WATER CLOSETS.

		s.	d.
The "Ovington" wash-down and trap, s.o.	each	14	6
Whiteware pedestal, pan and trap in one	,,	34	6
Mahogany seat...	,,	17	9
The "Avalanche" wash-out	,,	16	6
Trap, with vent extra...	,,	1	0
The "Eos" (in one piece), white	,,	29	0
The "Unitas," white	,,	40	0
,, raised and ornamented	,,	75	0
Bramah's spring-valve closet	,,	110	0
,, copper bellows regulator...	,,	105	0
Hayward Tyler's best quality valve closets, brass fittings	,,	63	0
Shank's "Citizen" wash-down	,,	28	6
Hellyer's "Optimus" valve-closet, with waste preventer	,,	150	0
Moule's earth closet, self-acting	,,	50	0
Galv. iron brackets for closet seats	,,	3	0
Closet seats, with hinge cover, mahogany, best quality...	,,	30	0
"Artisan" white basin and trap	,,	10	6
Fixing only, wash-down w.c. basin and trap, with hard-wood seats, W.W.P. cistern and brackets, and 6 ft. of flush-pipe, complete	,,	15	2
Winn's "Acme" galv. iron siphon cistern, s.o.	,,	30	0
"The Peckham" galv. iron W.W.P. cistern, 2 gals., s.o.	,,	24	0
Deval's patent ditto, ditto	,,	27	6
Galv. iron brackets for above cisterns	,,	1	0
Field's self-acting flushing siphon cistern, 100 gals. ...	,,	192	0
,, ,, ,, ,, 50 ,, ...	,,	144	0
,, ,, ,, ,, 20 ,, ...	,,	108	0
,, ,, ,, ,, 5 ,, ...	,,	54	0

URINALS.

		s.	d.
Small angle urinal, 13 in. wide, white, unfixed	each	7	6
"Bedford" ditto, ditto	,,	15	0
Tylor's urinal, flushing with lip	,,	23	6
Cocks for urinals, with unions both ends	,,	9	0
Fixing only, flat-backed urinals, including waste-pipe ...	,,	2	6
,, angular ,, ,, ,, ...	,,	3	0
Zinc sparge pipe, ¾ in. diam., and fixed	per ft. run	0	8½
Extra for stopped end	each	0	1½

LAVATORY BASINS.

Lavatory basin, white, 10 in., with overflow, s.o. ...	each	1	9
,, ,, 14 in. ,, ,, ...	,,	3	6
,, ,, 16 in., with washer and plug, s.o....	,,	6	6
Add if fixed	,,	3	6
Fixing only, Jenning's basins, complete	,,	6	0
Doulton's enamelled slate lavatory tops, 2 ft. 6 in. to each person, with 14-in. basin, plug, valve, and skirting ...	,,	37	6
Tip-up with oval basin, 15½ in. by 17½ in., enamelled slate top and skirting	,,	85	0
Cam-action lavatory valve, hot or cold, yellow metal ...	,,	9	3
,, ,, ,, silvered	,,	11	0
¾-in. gunmetal screw-down lavatory valve	,,	3	6
¾-in. plated ,, ,, ...	,,	4	0
¾-in. spring stop valve, screwed for iron	,,	7	9
Brass flat link chain	doz. yds.	2	6

SINKS.

Fireclay enamelled sink, 36 in. by 22 in. by 10 in., and fixed	each	69	6
Jenning's enamelled pantry sink, 42 in. long	,,	145	0
Tyler's or Harston's slop sink, 20 in. by 20 in.	,,	57	6
Doulton's slop sinks for hospitals, enamelled	,,	252	0
Housemaid's slop-receiver, with slate sink and ¾-in. cock	,,	90	0
Hayward Tyler's slop-receiver, white	,,	9	0
Tye and Andrews' galvanised iron sink trap, 3 in. ...	,,	6	9

BATHS.

Cast-iron enamelled bath, 5 ft. 6 in. long, supplied only ...	each	130	0
Shank's enamelled metallic "Universal" bath, ditto ...	,,	125	0
Galvanised tinned iron, 5 ft. 6 in. long, supplied only ...	,,	90	0
Copper bath ,, ,, ,, ...	,,	200	0
Zinc bath ,, ,, ,, ...	,,	67	0
Plain porcelain bath ,, ,, ,, ...	,,	180	0
Earthenware bath, 5 ft. 6 in. long, and fittings, first class	,,	240	0
Fixing only, cast-iron baths of any make, and connecting to waste	,,	6	0
Cliff's Roman bath, glazed inside only, supplied only ...	,,	150	0
,, ,, glazed in and out	,,	280	0
12-in. Bracket shower, in copper, with W.I. tube, handles and chain	,,	30	0
Geysers or water heaters for bath, heats 2 gals. per minute	,,	90	0

Hot-water Pipes, &c.

The following prices are quoted for hot-water pipes by a well-known firm of heating engineers :—

Description.		3 in.		4 in.	
		s.	d.	s.	d.
Socket pipes in 9-ft. lengths..................	per yard	2	3	2	6
,, ,, 6-ft. ,, ...	,,	2	3	2	6
Coil or spigot pipes in 9-ft. lengths	,,	2	3	2	6
Inside bend, spigot, and socket	each	2	3	3	9
Outside ,, ,, ,, ...	,,	4	0	6	0
Diminishing bend 4 in. to 3 in.	,,	2	3	3	9
Outside ,, ,, ...	,,	4	0	6	0
Eighth bends, double sockets, outside ...	,,	3	9	5	3
,, ,, ,, ,, inside ...	,,	3	0	4	6
Bends..	,,	2	3	3	9
Throttle valves, spigot, and socket.........	,,	13	6	15	9
,, ,, double sockets	,,	13	6	15	9
Three-way siphon	,,	6	9	9	0
Four-way siphon................................	,,	9	0	13	6

Zincwork.

Description.		12 Gauge.		14 Gauge.		16 Gauge.	
		s.	d.	s.	d.	s.	d.
Zinc laid complete on flats or gutters, including rolls..........................	per ft. sup.	0	6½	0	7½	0	9
Zinc in flashings in lieu of lead	,,	0	7	0	8½	0	10
Zinc semi-circular eaves gutters, 5 in. diam., and fixing	per ft. run	0	7	0	9	0	10¾
Ditto, 4 in. ditto...........................	,,	0	7	0	8	0	9½
Ogee or moulded eaves gutters, 4 in. ditto	,,	0	8½	0	10	0	11½
Mitres or angles in above gutters ...	each	0	4	0	4	0	4
Stopped ends in ditto	,,	0	8	0	8	0	8
Outlets in ditto	,,	0	9	0	9	0	9
Zinc rainwater pipes, 3 in. diam., and fixed	per ft. run	0	7½	0	9	0	11
Ogee heads for ditto, ditto	each	3	3	3	9	4	9
Shoes or elbows, ditto	,,	1	6	1	9	2	3
Zinc sparge pipe, ¾ in. diam., perforated and fixed	per ft. run	—		0	8½	—	
Add, if copper...............................	,,	—		0	4	—	
Labour only in fixing sheets of perforated zinc.............................	per ft. sup.	0	1¾	0	2	0	2½

		s.	d.
"Italian" zinc roofing, including ridging and flashing, No. 15 gauge	per square	55	0

ZINCWORK—*continued.*

		s.	d.
Polished pewter, 3½ lb. per foot super., nailed on counter tops with copper nails, and dressing round edges ...	per ft. sup.	7	0
Ditto, ditto ...	per lb.	1	7

MATERIALS.

(SUPPLIED ONLY.)

		s.	d.
Cement for water-closets ...	per lb.	0	2¾
Cement, red-lead... ...	,,	0	3
Charcoal, alder or willow ...	per bushel	2	0
,, animal... ...	,,	20	0
Cloth, soldering, linen tick ...	per yard	2	0
Collars and washers, lead, for small pipes or cocks...	each	0	2
,, ,, leather, ,, ,, ...	,,	0	1
Dubbin, currier's ...	per lb.	1	3
Felt for flanges ...	per ft. sup.	0	6
Guttapercha, sheet ...	per lb.	3	0
Hooks, iron, wall or pipe, ¼ lb. each or under ...	,,	0	4¼
,, ,, ,, galvanised ...	,,	0	6½
Indiarubber, vulcanised, for flanges of pipes, &c. ...	,,	4	6
Indiarubber solution ...	per gal.	6	0
Red-lead, ground in oil ...	per lb.	0	3
White-lead, ,, ...	,,	0	3½
Lead for collars and flanges of large pipes, cut to size ...	,,	0	3½
Resin ...	,,	0	1
Sal-ammoniac ...	,,	0	6
Spirits of salts (muriatic acid)...	per pint	0	6
Soda ash ...	per lb.	0	4
Solder, plumber's (2 lead, 1 tin) ...	,,	0	8
,, tinman's (1 lead, 2 tin) ...	,,	1	0
Tallow, Russian ...	,,	0	6
Tin in blocks or ingots ...	,,	1	3
Tow, white ...	,,	0	3¼
Tubing, vulcanised indiarubber, ½ in. diam....	per ft. run	0	9
,, ,, ,, ¾ ,, ...	,,	1	0
,, ,, ,, 1 ,, ...	,,	1	9
Washers, lead ...	per lb.	0	4
,, brass ...	,,	1	6
Wine, spirits of ...	per pint	3	6
,, methylated ...	,,	1	0
Zinc nails ...	per lb.	0	6
Zinc, ingot ...	,,	0	3
,, sheet, perforated any pattern ...	per ft. sup.	0	6
Wages, plumber's ...	per hour	0	11
,, plumber's mate...	,,	0	7
,, zincworker's ...	,,	0	10½
,, zincworker's labourer ...	,,	0	7

ANALYSIS.

The trade discount off plumber's brasswork is from 10 to 15 per cent. Discount 2½ per cent. for cash. Discount off sanitary goods, such as w.c.'s and lavatories, 10 per cent.

The allowance for waste or tare on old lead varies from 4 lb. to 6 lb. per cwt.; but 4 lb. is that most generally adopted.

In selling old lead it is customary to allow 120 lb. to the cwt. Solder, if in considerable quantity, is cut out and sold separately.

Flats, Gutters, and Flashings.—In this class of work the expansion and contraction of the metal constantly has to be allowed for. Sheets not more than 2 ft. 6 in. or 3 ft. wide, and drips not more than 7 ft. or 8 ft. apart, are desirable. Flats should have a fall of at least 1 in. in 10 ft., and drips should be at least 2 in. high.

In gutters a fall of $1\frac{1}{2}$ in. in 10 ft. is usually allowed, and the lead should extend at least 9 in. under the slates, and 6 in. vertically on the walls.

Flashings should be well wedged with lead wedges into a joint of the brickwork, and then be pointed in Portland cement. Where they are inserted into a groove or chase in stonework, they should be "burnt in"—or, more accurately, melted in—by forming a temporary clay trough under the chase, and then pouring in melted lead. Soakers should extend laterally for about half the width of a slate, in addition to the part which is bent up vertically against the wall. Cover-flashings should overhang the lead they cover to a depth of at least 4 in.

Where lead has to be secured tightly to woodwork, which should be as seldom as possible on account of its expansion and contraction, "lead dots" may be used. They are made by slightly hollowing a place in the woodwork, dressing the lead into the hollow, driving a strong screw or nail through the lead and the woodwork in the centre of the hollow, and then filling up the depression in the lead with solder.

All soil and ventilating pipes should be blocked out from the walls so as to avoid the use of bends or knees at plinths, &c., and, where possible, to be made to pass straight through the eaves instead of around them.

Solders.—Plumbers' solders are composed of lead and tin. "Coarse solder," which melts at about 480° Fahr., contains $2\frac{1}{2}$ parts of lead to 1 part of tin. Ordinary solder, melting at about 440°, is composed of 2 parts of lead to 1 of tin. "Fine solder" melts at about 380°, and contains equal parts of lead and tin. Tinman's solder is made of 1 part lead and 2 parts tin. By adding tin, and especially by adding a small quantity of bismuth, still more fusible solders can be made;

and pewterer's fine solder, which consists of 1 part of lead to 2 of tin and 1 of bismuth, melts below the boiling-point of water. Lead by itself melts at 620°. Fine solders, which are used where strength is not specially required, are melted by a copper bit. Coarse solders, on the contrary, which make stronger joints, are melted over the fire, and applied with a ladle.

Ordinary plumber's solder is usually priced at 8*d.* per lb., but the net trade price is 6*d.* Tinman's solder stated at 1*s.* 1*d.* per lb. is 8*d.* net trade price.

Average Market Prices.

	Per ton. £	s.	d.		Per cwt. £	s.	d.
Sheet lead, 3 lb. and upwards	14	0	0	=	0	14	0
Pig lead, in 1 cwt. pigs	11	0	0	=	0	11	0
Zinc, English	24	0	0	=	1	4	0
,, Vieille Montagne	26	10	0	=	1	6	6
Tin, English ingots	127	0	0	=	6	7	0
,, Straits	125	10	0	=	6	5	6
Spelter, Silesian	21	0	0	=	1	1	0

Milled Lead and Laying in Gutters and Flats, &c.—The price of sheet lead is £14 per ton, or 14*s.* per cwt. Allow 6*d.* for loss or waste on cuttings, which are sold from 2*s.* to 2*s.* 6*d.* per cwt. less than cost, and 4 lb. deducted for "tare." For solder put down $1\frac{1}{2}$ lbs. per cwt. of lead, and for labour $3\frac{1}{2}$ hours plumber and mate.

	s.	d.
Sheet lead, per cwt.	14	0
Loss on cuttings...	0	6
Solder, $1\frac{1}{2}$ lb. at 8*d.*	1	0
Labour, $3\frac{1}{2}$ hours plumber and mate at 11*d.* and 7*d.*	5	3
	20	9
Add 15 per cent. profit	3	3
Price per cwt.	24	0

Labour and solder for milled lead in sinks and safes would be about 7*s.* per cwt.

Milled Lead in Flashings to Parapets.—The lead for this costs about 1*s.* more per cwt. than for gutters and flats, and a trifle extra labour, making a total of 25*s.* 4*d.* per cwt.

Soldered Angle.—This is simply solder and labour.

	s.	d.
1 lb. solder at 8*d*.	0	8
Labour and profit	0	4
Price per foot run	1	0

Bossed Ends to Rolls.—These mean extra labour and solder, and they are worth from 6*d*. to 9*d*. each, including profit.

Lead Pipes.—In the War Department Schedule these are taken at per cwt. of all sizes; but in ordinary bills of quantities they are priced at per foot run.

$\frac{3}{4}$-*in. Strong Lead Pipe and Fixing.*—By a reference to the "Memoranda" it will be seen that this size and strength weighs 9 lb. per yard, or 3 lb. per foot run. Lead pipe is worth more than sheet lead, about 2*s*., or 16*s*. per cwt.

	s.	d.
$\frac{3}{112}$ cwt. lead pipe at 16*s*. per cwt. = per foot	0	5
Solder and wall hooks	0	$2\frac{1}{2}$
Labour, $\frac{1}{7}$ hour plumber and mate at 11*d*. and 7*d*.	0	$2\frac{1}{2}$
	0	10
Add 15 per cent. profit	0	2
Price per foot run	1	0

Soldered ends to ditto 6*d*. each.

Other sizes of pipes are worked out in exactly similar fashion, and the prices for labour and solder would be for pipes :—

1 in.	...	$1\frac{1}{4}$ in.	...	$1\frac{1}{2}$ in.	...	2 in.
6*d*.	...	$6\frac{1}{2}$*d*.	...	7*d*.	...	8*d*.

4-*in. Soil-pipe of* 7 *lb. Lead, with Collars, Joints, and Fixing.*—This is the usual size and weight specified for a soil-pipe. A 4-in. diam. pipe is rather more than a foot in girth, and so the weight would be $7\frac{1}{2}$ lb. per foot run, to which add $1\frac{1}{2}$ lb. for tacks, or 9 lb. total. (See weights in "Memoranda.") Soil-pipe costs about 4*s*. per cwt. more than sheet lead, or 18*s*. per cwt.

	s.	d.
$\frac{9}{112}$ cwt. mill-drawn lead pipe and tacks at 18*s*.	1	5
Solder, &c.	0	5
Labour fixing, $\frac{1}{2}$ hour plumber and mate at 11*d*. and 7*d*.... ...	0	9
	2	7
Add 15 per cent. profit	0	5
Price per foot run	3	0

Extra for Bends in ditto.—This is labour and solder only, the bends being already measured in the length of pipe.

	s.	d.
Labour, 1 hour plumber 11*d*., and mate 7*d*.	1	6
$1\frac{1}{2}$ lb. solder at 8*d*.	1	0
Fuel, &c., say	0	3
	2	9
Add 15 per cent. profit	0	5
Price of each...	3	2

Extra for Soldered Joints in ditto.—These are worth 3*s*. or 3*s*. 6*d*. each for labour, solder, and profit.

Soldered Joint to $1\frac{1}{2}$-in. Lead Pipe.—This is made up as follows, but the amount of solder will vary with the workman. (See "Memoranda.")

	s.	d.
$1\frac{3}{4}$ lb. solder at 8*d*.	1	2
$\frac{1}{2}$ hour plumber and mate at 11*d*. and 7*d*.	0	9
Fuel, &c.	0	1
	2	0
Add profit	0	4
Price of each	2	4

Boyle's Air-pump Ventilator, 8 in. diam., for 4-in. soil-pipe, and fixing. Design No. 227.

	s.	d.
Cost of 8-in. ventilator	10	6
4 hours plumber at 11*d*.	3	8
	14	2
Add profit	2	1
Price of each	16	3

Connection of Soil-pipe with Drain.—As a simple connection, without bend or brass collar, this would include a lead flange out of 7 lb. lead, soldered to 4-in. pipe fitted to socket of drain-pipe, and sealed with cement. This flange or collar is for the purpose of thickening the pipe where it joins the drain. If the collar is 1 ft. long it would be about 1 sq. ft. in area.

	s.	d.
Lead flange out of 7 lb. lead	1	6
Labour and solder	2	0
Making good in cement	0	6
	4	0
Add profit	0	7
Price of each	4	7

Drawn Lead Traps.—8 lb. lead is used in these. One soldered joint is taken. For amount of solder see "Memoranda."

	s.	d.
2-in. trap. Cost of 2-in. trap, with brass screw plug	4	6
1 joint, $2\frac{1}{4}$ lb. solder at 8*d*.	1	6
1 hour plumber and mate at 11*d*. and 7*d*.	1	6
Fuel, &c., say	0	1
	7	7
Add profit	1	1
Price of each	8	8

	s.	d.
4-in. trap. Cost of 4-in. siphon trap, 8 lb. lead	9	0
1 joint, $4\frac{1}{2}$ lb. solder at 8*d*.	3	0
1 hour plumber and mate at 11*d*. and 7*d*.	1	6
Fuel, &c., say	0	2
	13	8
Add profit	2	1
Price of each	15	9

Plumber's fittings and brasswork comprise a large variety of articles, and can only be priced by referring to the illustrated catalogues and price lists of well-known manufacturers. But the labour in fixing, soldering, &c., is not so easily found, as the time required by a plumber and his mate is seldom uniform. The analysis is simple and easy enough, however, and it is only necessary to give a few examples. The difference between good and cheap plumbing is very great, as lighter weights can be easily substituted for the heavy ones specified.

2-*in. Pantry Washer, Plug and Chain,* with perforated bottom, screw shank, and fixing complete.

	s.	d.
Washer and waste, with chain and grating	2	2
1 joint, $2\frac{1}{4}$ lb. solder at 8*d*.	1	6
Fuel, &c., say	0	1
1 hour plumber and mate at 11*d*. and 7*d*.	1	6
	5	3
Add profit	0	9
Price of each	6	0

$\frac{3}{4}$-*in. Brass Screw-Down Bib-Cock,* screwed for iron pipe, and fixed. Farmiloe's price is 4*s*., and there is the joint.

	s.	d.
Cost of $\frac{3}{4}$-in. cock, with screwed end	4	0
$\frac{1}{2}$ lb. solder at 8*d*.	0	4
$\frac{1}{2}$ hour plumber and mate at 11*d*. and 7*d*.	0	9
	5	1
Add profit	0	9
Price of each	5	10

$\frac{3}{4}$-*in. Brass Screw Union*, or connector, with fly-nut for iron or slate cistern, and joint to lead-pipe.

	s.	d.
Cost of $\frac{3}{4}$-in. union	1	9
1 lb. solder at 8*d*.	0	8
Fuel, &c.	0	$0\frac{1}{2}$
Red-lead for joint	0	2
$\frac{1}{4}$ hour plumber and mate at 11*d*. and 7*d*.	0	$4\frac{1}{2}$
	3	0
Add profit	0	5
Price of each	3	5

Connection with Company's Main.—Allow for making connection with water company's main, including $\frac{3}{4}$-in. brass screw ferrule, soldered joint, opening and making good road, fees, &c. This is an item that can only be satisfactorily priced out by knowing the site and the district company's fees, and if any length of pipe is required to connect with main. The charge by the West Middlesex Company is about 15*s*. for opening the ground, providing ferrule, and fixing it. This is a very moderate one, the New River charging much higher. The following is an imaginary typical case.

	s.	d.
Company's fee	15	0
Brass ferrule	1	6
Soldered joint to $\frac{3}{4}$-in. lead pipe	1	0
Opening and making good road, half a day's labour, or $4\frac{1}{2}$ hours labourer at $6\frac{1}{2}$*d*.	2	6
	20	0
Add profit	3	0
Total cost	23	0

Hopper Closet and Fixing.—The following analysis of this item has been given in the *Building News*. The closet to be a short hopper, with flushing rim, on pedestal, with 8-lb. lead siphon trap; also one galvanised 3-gallon siphon water-waste preventer on brackets, pull and chain,

and make connection, joints, &c. Such closets are obtainable in several qualities. Nicholls and Clarke's "Isis" pan and trap in two pieces costs 6*s.*, cane colour and white basin trap. It is a cheap and efficient closet, with a $4\frac{1}{2}$-in. water surface. With the same basin, but with lead trap, the price is 18*s.* 9*d.*

	£	s.	d.
Cost of hopper, with lead trap	0	18	9
3-gal. galvanised water-waste preventer cistern	1	10	6
$1\frac{1}{4}$-in. lead flush pipe from ditto and fixing, say 10 ft. run at 1*s.* 2*d.*	0	11	8
2 soldered joints at 2*s.*	0	4	0
$\frac{1}{2}$-in. supply pipe to waste-preventer cistern and fixing, 2 ft. run at 6*d.*	0	1	0
Stop-cock, with unions at ends	0	7	6
$\frac{3}{4}$-in. lead overflow pipe through wall, 2 ft. run at 9*d.*... ...	0	1	6
	3	14	11
Add 15 per cent. profit	0	11	1
Price of each, complete	4	6	0

Water-waste Preventing Cistern.—There are many varieties of cast-iron water-waste preventing cisterns, from 8*s.* 6*d.* to £3 each. A good one costs 21*s.*, and should hold three gallons.

	£	s.	d.
Cost of cistern	1	1	0
Two brackets, chain and ring	0	3	0
Labour fixing, including $\frac{1}{2}$-in. supply joint, $\frac{3}{4}$-in. overflow joint, and $1\frac{1}{4}$-in. service joint	0	8	6
	1	12	6
Add 15 per cent. profit	0	5	0
Price of each	1	17	6

Ordinary galvanised wrought-iron cisterns cost from 1*d.* to 5*d.* per gallon, supplied only.

Lavatory Basin, and Fixed.—White glazed lavatory basin, 16 in. diameter, with 1-in. brass washer, plug, and chain.

	s.	d.
Lavatory basin, 16 in. diameter	3	0
1-in. washer, plug, chain, &c., and fixing	3	6
Bedding basin in red-lead putty	0	9
Soldered joint to 1-in. pipe	1	3
	8	6
Add profit	1	3
Price of each	9	9

Fireclay Enamelled Sink, and Fixed.—The sink is 36 in. by 22 in. by 10 in., and is fixed on strong iron brackets.

	£	s.	d.
Cost of sink, say	2	10	0
Brackets	0	3	6
Overflow and fixing	0	7	0
	3	0	6
Add profit	0	9	0
Price of each	3	9	6

Cast-iron Bath, and Fixed.—Provide and fix complete a superior quality cast-iron enamelled bath, 5 ft. 6 in. long, in bathroom. The same authority in the *Building News* gives the following :—

	£	s.	d.
Cost of bath, supplied only	6	10	0
10 ft. run 1¼-in. lead overflow pipe, carried through wall, at 1*s.* 2*d.* per foot	0	11	8
One soldered joint to ditto...	0	1	10
One copper flap and soldering to pipe	0	1	6
30 ft. run 1½-in. lead waste, and fixing with cast tacks, at 1*s.* 6*d.* per foot	2	5	0
Incasing ditto with slag wool	1	0	0
One connection of 1½-in. lead pipe to cast-iron 3 in. diam. pipe, brass thimble, and caulking	0	7	6
Copper waste with trap, and connect to bath	2	0	0
8 ft. run 1-in. lead supply to bath at 1*s.*...	0	8	0
Two soldered joints to ditto at 1*s.* 3*d.*	0	2	6
Provide and fix two plated screw-down taps to bath, at 25*s.*	2	10	0
	15	18	0
Add 15 per cent. profit	2	7	8
Total price	18	5	8

Hot-water Cylinder.

Fix at side of kitchen-range a wrought-iron frame on brackets, and a 50-gallon strong galvanised iron circulating cylinder, with pipes, connections, &c., complete.

This item would embrace several details : the drilling of cylinder for 1½-in. flow and return steam-pipe, a gunmetal stop-cock to shut off cold supply with square head and spanner above the trap, a short length of pipe with bib-cock to empty cylinder, encasing cylinder with asbestos, a short length of pipe on top of cylinder, and dead-weight safety-

valve. The several items may be put down thus (from the *Building News*):

	£	s.	d.
A 50-gallon galvanised iron cylinder, say	4	0	0
Iron frame on brackets, &c., say	1	5	0
30 ft. run $1\frac{1}{2}$-in. steam-pipe, flow and return, from boiler to cylinder, &c., 1*s.* 3*d.* per foot	2	10	0
Three drillings in boiler, at 4*s.*	0	12	0
Gunmetal stop-cock, with square head and spanner, including joints and a draw-off bib-cock, say	1	15	0
Two connections to cylinder, 5*s.*	0	10	0
Incase cylinder with asbestos, say	1	10	0
25 ft. run 1-in. steam-pipe, flow and return, 10*d.*	1	0	10
12 ft. 1-in. steam exhaust, carried above roof	0	10	0
Dead-weight safety-valve and fixing	0	12	0
12 ft. run 1-in. pipe to bath, including taking up and relaying floor, bends, &c., 2*s.*	1	4	0
32 ft. run $\frac{3}{4}$-in. pipe to supply sinks, 9*d.*...	1	4	0
11 ft., taking up floor, notching joists, &c., 5*d.*	0	4	7
No. 2 screw-down 1-in. stop-cocks to bath, with joints, 10*s.* ...	1	0	0
,, $\frac{3}{4}$-in. bib-cocks, 9*s.*	0	18	0
	18	15	5

Hot-water Apparatus.

(From the *Building News*.)

Provide and fit up complete to architect's satisfaction a hot-water apparatus from kitchen boiler, including all necessary return-and-flow wrought-iron pipes, a hot-water cistern in first-floor lavatory to hold 20 gallons, all necessary bends, elbows, taps, branches, and connections to bath, lavatory sinks, &c.

It is best to provide a sum for this work, or obtain an estimate, as any correct pricing of this item is not possible without a careful inspection of plans, the length of pipes from boiler to hot-water tank and cold cistern, the length of branches, the number of fittings. Let us suppose a three-story dwelling-house, the cold-water cistern in the upper story, the hot-water cistern in the floor beneath near ceiling of lavatory or bathroom, and the boiler in kitchen on ground floor—a very ordinary arrangement. The boiler and cistern are provided already. There would be about 30 ft. of $1\frac{1}{4}$-in. steam-pipe, to flow and return from boiler to cylinder at, say, 1*s.* per foot; add to this, notching joists, relaying floors, and all connections, say 1*s.* 9*d.* per foot.

	£	s.	d.
Cost of steam-pipe, &c.	2	2	6
2 drillings in boiler and connections	0	5	0
3 connections to tank, 2*s.* 6*d.* each	0	7	6
Carried forward	2	15	0

	£	s.	d.
Brought forward	2	15	0
Hot-water tank, 20 gallons, and fixing on bearers, &c. ...	2	14	0
No. 4 bends	0	8	6
1-in. stop-cock, with spanner	0	13	6
No. 3 tee-pieces, at 2*s.* 6*d.*...	0	7	6
8 ft. run 1-in. steam exhaust turned over into cistern, at 9*d.*	0	6	0
1 joint...	0	2	6
15 ft. ¾-in. branch to sink	0	11	0
5 ft. 3-in. ditto to bath, with connections, say	0	6	0
	8	4	0
Add 15 per cent.	1	4	6
	9	8	6

These are approximate prices.

Provide and fix on strong iron brackets a 50-gallon strong galvanised iron circulating cylinder.

The cost of cylinder would be about £4 10*s.*, and brackets, say, 15*s.*

	£	s.	d.
Cost of cylinder	4	10	0
Brackets	0	15	0
Labour fixing, say	0	5	6
	5	10	6

One estimate for this work is put down at £7 10*s.*—a very high price.

Zincworker.

Zincwork is measured by the foot super., allowances being made for drips, laps, and passings. For roofing purposes the sheets are from 7 ft. to 10 ft. in length, and 2 ft. 8 in. to 3 ft. wide, the gauges and weights being already given in "Memoranda." The Vieille Montagne zinc system of laying is considered the best (see Messrs. Braby's pamphlet). Zinc flashings are formed like those of lead, and the edges stiffened by being turned round to form a bead. Drips to flats should be 2½ in. deep, and to gutters 1½ in. deep. Soldering should be avoided. It is usual to add 40 per cent. for rolls, turns, laps, welts, and flashings, to the measurement as laid on a plain flat.

The price of Vieille Montagne zinc is £26 10*s.* per ton, or 26*s.* 6*d.* per cwt. As No. 14 gauge weighs 18¾ oz. per foot super., it follows that the price is $\frac{1\frac{3}{16}}{112}$ of 26*s.* 6*d.*, equals 3½*d.* per square foot. Zincwork is generally let to a

zincworker, or to a zinc company, who will lay it complete and better than ordinary workmen. If the contractor's own men lay it, the cost would be detailed as follows, including rolls, as these are added to the superficial measurement.

	s.	d.
No. 14 gauge zinc, per foot super.	0	3½
Waste in cutting	0	1
Labour and profit, say	0	3
Price per foot super.	0	7½

CHAPTER XVI.——PLASTERER.

MEMORANDA.

Lime.—100 tons of blue lias lime yield $59\frac{1}{2}$ tons of quicklime, 1,583 bushels of ground lime, and 2,063 bushels of slaked lime; 74 gallons of water are required for slaking 1 ton of quicklime.

1 bushel of lias lime	= 75 lb.	1 bushel of stone lime	= 70 lb.
3 ,, ,,	= 1 bag.	2 ,, ,,	= 1 sack.
30 ,, ,,	= 1 ton.	16 ,, ,,	= 1 yd. cube.
10 bags ,,	= 1 ton.	8 sacks ,,	= 1 yd. cube.
1 barrel of lime	= 5 ft. cube.	2 yards cube ,,	= 1 ton.

A "hundred" of lime = 100 pecks, or 25 bushels.
A chaldron (dry measure) = 32 striked bushels, or 41 ft. cube.
A single load = a hundred of lime = 1 cubic yard heaped up.
A cubic yard = 21 striked bushels, or 17 heaped bushels.
A striked bushel = 1·284 cubic ft., or $\frac{1}{21}$ yard cube.

Sand.

1 yard cube of dry sand	= 22 cwt.
,, wet ,,	= 30 cwt.
,, sand	= 1 single load.
,, ,,	= 21 striked bushels.
1 bushel of sand	= 107 lb.
3 ,, ,,	= 1 barrel.
20 feet cube of river sand	= 1 ton.
21 ,, pit ,,	= 1 ton.

Hair.

A bushel of dry hair weighs about 14 lb., and is classed according to quality as Nos. 1, 2, and 3, the latter being the best.

Add 1 lb. of hair to every 2 ft. cube of coarse stuff for good work.

Add 1 lb. of hair to every 3 ft. cube of coarse stuff for ordinary work.

Laths.

A bundle contains 360 to 500 ft. run, according to length of lath.

The lengths vary from 3 ft. to 5 ft., increasing 6 in. at a time. The number of laths in a bundle therefore varies. They are spaced about $\frac{3}{8}$ in. apart. Thirty bundles = 1 load.

Single fir laths are 1 in. broad by $\frac{1}{8}$ in. to $\frac{3}{16}$ in. thick.
Lath and half-laths are 1 in. broad by $\frac{3}{16}$ in. to $\frac{1}{4}$ in. thick.
Double laths are 1 in. broad by $\frac{1}{4}$ in. to $\frac{3}{8}$ in. thick.
1 yard super. requires 24 laths, each 3 ft. long.
,, ,, 21 ,, ,, 3 ft. 6 in. long.

Nails.

Lath nails are either wrought, cut, or cast. The latter, being cheapest, are most often used. For good work they should be galvanised, or of zinc.

Single lath nails are $\frac{3}{4}$ in. long, and 950 weigh 1 lb.
Lath and half nails are $\frac{7}{8}$ in. long, and 850 weigh 1 lb.
Double lath nails are 1 in. long, and 750 weigh 1 lb.

Portland Cement.

1 bushel of Portland cement			= 112 lb.
2 bushels	,,	,,	= 1 bag.
1 bag	,,	,,	= $2\frac{1}{2}$ ft. cube.
1 ,,	,,	,,	= 2 cwt.
10 bags	,,	,,	= 1 ton.
1 ft. cube	,,	,,	= 87 lb.
1 cental, London custom			= 100 lb.
1 bag	,,	,,	= 200 lb.
1 ,,	,,	,,	= 2 centals.
11 bags	,,	,,	= 1 yd. cube.
1 yd. cube	,,	,,	= 1 ton.
1 cask, or 4 centals, net			= 400 lb.

Plaster of Paris.

1 bag of plaster of Paris			= 14 lb.
1 sack	,,	,,	= 2 cwt.
1 ,,	,,	,,	= 3 bushels.
1 bushel	,,	,,	= 75 lb.
1 cask	,,	,,	= $2\frac{1}{2}$ cwt.
10 sacks	,,	,,	= 1 ton.

Roman Cement.

1 bushel of Roman cement			= 78 lb.
3 bushels	,,	,,	= 1 sack.
5 ,,	,,	,,	= 1 cask.
1 cask	,,	,,	= $3\frac{1}{2}$ cwt.
1 ,,	,,	,,	= 4 ft. cube.
1 ft. cube	,,	,,	= 60 lb.

1 bushel of Roman cement and 1 sand cover $4\frac{1}{2}$ sq. yds., $\frac{1}{2}$ in. thick.

Parian Cement.

1 bushel of Parian cement			= 75 lb.
3 bushels	,,	,,	= 1 sack.
1 sack	,,	,,	= 2 cwt.
1 cask	,,	,,	= $2\frac{1}{2}$ cwt.
1 ,,	,,	,,	= 4 bushels.
1 ,,	,,	,,	= $1\frac{1}{4}$ sack.

Keen's Cement.

1 bushel	of Keen's	cement	=	75 lb.
3 bushels	,,	,,	=	1 sack.
1 sack	,,	,,	=	2 cwt.
1 cask	,,	,,	=	$2\frac{1}{2}$ cwt.
1 ,,	,,	,,	=	4 bushels.
1 ,,	,,	,,	=	$1\frac{1}{4}$ sacks.

1 part Keen's cement and 2 parts sand will cover 15 yards super. $\frac{1}{2}$ in. thick.

4 bushels of Keen's or Parian cement and 4 bushels of sand will cover 10 yards super. $\frac{1}{2}$ in. thick.

Miscellaneous.

1 cwt. of Martin's cement neat will cover 3 yards super. $\frac{1}{2}$ in. thick.

1 cwt. of Martin's cement with equal sand will cover 6 yards super. $\frac{1}{2}$ in. thick.

1 bushel of selenitic lime	= 62 lb.
1 sack ,, ,,	= 132 lb.
17 sacks ,, ,,	= 1 ton.
About two hods of plaster	= 1 bushel.
1 firkin of double size	= 48 lb.
2 dozen whiting	= 1 cwt.
1 cubic yard of coarse stuff	= 1 load.
Weight of 1 yard super. lath, plaster, float, and set ceilings	= 98 lb.

A box 13 in. × 13 in. × $13\frac{1}{8}$ in., or 12 in. × 12 in. × $15\frac{3}{8}$ in., inside measurements, will hold 1 bushel of Portland cement.

A pound of glue makes a gallon of size.

Proportions of Materials for Plastering.

(Quantities based on Seddon).

Description of Work.	Lime.	Sand.	Hair.	Water.	Laths.	Nails.	Labour: Plasterer and Labourer.
To cover 100 yds. super.—	yds. cube.	yds. cube.	cwt.	gal.	b'dls.	lb.	hrs.
Rendering, 1 coat	1	2	$\frac{16}{112}$	100	—	—	18
Render 1 coat, and set with fine stuff	2	2	$\frac{25}{112}$	200	—	—	27
Render, float, and set with fine stuff	$2\frac{1}{3}$	$2\frac{1}{3}$	$\frac{30}{112}$	250	—	—	45
Lath and plaster, 1 coat ...	1	2	$\frac{16}{112}$	100	22	14	27
Lath, plaster, and set.........	2	2	$\frac{28}{112}$	220	22	14	45
Lath, plaster, float, and set	$2\frac{1}{2}$	$2\frac{1}{2}$	$\frac{32}{112}$	270	22	14	60
To cover $4\frac{1}{2}$ yds. super.— Lathing only, lath and half	—	—	—	—	1	$\frac{5}{8}$	plasterer and boy. 1

Proportions of Materials for Plastering—*continued.*

$\frac{1}{10}$ ft. cube unslaked lime ... ... $\frac{1}{33}$ ft. cube plaster of Paris ... ... 1 gallon of water	will cover 1 yard super. setting with putty and plaster.

Portland Cement.

Proportion of Materials.	$\frac{1}{2}$ in.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	$\frac{7}{8}$ in.	1 in.
	yds. super.	yds. super.	yds. super.	yds. super.	yds. super.
1 bus. of cement, neat	2·8	2·4	2·1	1·7	1·4
1 ditto, to 1 bus. ($\frac{1}{21}$ yd. cube) of sand	4·4	3·8	3·3	2·7	2·2
1 ditto, to 2 ditto ($\frac{2}{21}$ yd. cube) of sand	6·4	5·6	4·8	4·0	3·2
1 ditto, to 3 ditto ($\frac{3}{21}$ yd. cube) of sand	8·6	7·5	6·4	5·4	4·3
1 ditto, to 4 ditto ($\frac{4}{21}$ yd. cube) of sand	10·8	9·7	8·7	7·0	5·4
1 ditto, to 5 ditto ($\frac{5}{21}$ yd. cube) of sand	13·4	11·7	10·0	8·3	6·7

For labour see "Analysis."

Robinson's Cement.

1 cwt. of neat cement = $1\frac{1}{2}$ imperial bushels.
1 ,, ,, will cover 15 yards super. $\frac{1}{8}$ in. thick.
1 ,, cement and 1 sand ,, 7 ,, $\frac{1}{2}$ in. ,,
1 ,, ,, 2 ,, ,, 11 ,, $\frac{1}{2}$ in. ,,
1 ,, ,, 3 ,, ,, 15 ,, $\frac{1}{2}$ in. ,,

1 cwt. mastic 1 gal. oil ...	will cover 5 yards super. $\frac{1}{4}$ in. thick. ,, $2\frac{1}{2}$,, $\frac{1}{2}$ in. ,,

Limewhiting and Colouring.

Description of Work.	Lime.	Water.	Tallow.	Whiting.	Blue-black.	Glue or Size.	Ochre or Copperas.	Umber.	Prussian-blue.	Labour; Plasterer and Labourer.
To cover 100 yds. super.—	bsh.	gal.	lb.	lb.	lb.	lb. or gal.	lb.	lb.	lb.	hrs.
Limewhite, 1 coat	1	10	$\frac{3}{4}$	—	—		—	—	—	6
,, 2 coats	$1\frac{1}{2}$	17	$1\frac{1}{4}$	—	—		—	—	—	10
Whitening, with whiting and size, 1 coat	—	10	—	12	$\frac{1}{2}$	$1\frac{3}{4}$	—	—	—	7
Ditto, 2 coats	—	17	—	21	$\frac{3}{4}$	$2\frac{2}{3}$	—	—	—	12
Colouring in distemper, stone or buff, 1 coat ...	—	10	—	10	—	2	3	$\frac{1}{2}$	—	8
Ditto, French grey, 1 coat	—	10	—	12	—	$2\frac{1}{4}$	—	—	$1\frac{1}{2}$	8

ROUGH-CASTING.

Description of Work.	Lime.	Sand.	Hair.	Gravel.	Copperas.	Cow Manure.	Labour: Plasterer and Labourer.
To cover 100 yds. super.—	bsh.	yds. cube.	cwt.	yds. cube.	lb.	lb.	hours.
Rough-casting, 2 coats ...	20	2	$\frac{16}{112}$	$\frac{3}{4}$	—	—	15
Ditto, coloured buff.........	20	2	$\frac{16}{112}$	$\frac{3}{4}$	5	1	15

PRICES.

RENDERING WITH HAIRED MORTAR.

		Straight. s.	d.	Curved. s.	d.
Rendering, 1 coat	per yd. sup.	0	8¼	0	9½
,, and set with fine stuff ...	,,	1	0	1	2½
,, 2 coats ,, ...	,,	1	2	1	4
Render and float ,, ...	,,	1	1	1	5
Render, float, and set with fine stuff ...	,,	1	4½	1	7½
,, with putty and plaster	,,	1	8	1	11
Add if the rough coats are gauged, for each coat	,,	0	3	0	3

LATHING AND PLASTERING.

		s.	d.	s.	d.
Lathing only, lath and half	per yd. sup.	0	11½	1	1
Lath and plaster, 1 coat	,,	1	7¾	1	10
,, plaster, and set with fine stuff ...	,,	1	11	2	2
,, ,, ,, putty and plaster	,,	2	4	2	6½
,, and plaster, 2 coats, and set with fine stuff	,,	2	1½	2	4
Ditto, set with putty and plaster	,,	2	5	2	7
Lath, plaster, and float	,,	2	0	2	4
,, ,, ,, set with fine stuff	,,	2	3½	2	7
,, ,, ,, ,, putty and plaster	,,	2	7	2	10
Add if double fir laths are used	,,	0	3	0	4
Add if the rough coats are gauged, for each coat	,,	0	2	0	2

RENDERING WITH PORTLAND CEMENT.

		s.	d.	s.	d.
Render with pure Portland cement, ½ in. thick	per yd. sup.	1	10	2	2
Render and float, ¾ in. thick, with 1 cement to 1 sand	,,	1	11	2	4
Ditto, ditto, 1 cement to 2 sand	,,	1	8	2	2
Ditto, ditto, 1 cement to 3 sand	,,	1	4½	1	8
Add if trowelled fair to a hard, smooth surface	,,	0	6	0	8
Add if jointed in imitation of stone ...	,,	0	3	0	5

Friezes, Cornices, Mouldings, &c., in Plaster.

		Straight. s. d.	Curved. s. d.
Lath, plaster, float, and set, friezes and soffits	per ft. sup.	0 6	0 8
Ditto, panelled and moulded	,,	1 0	1 4
Render, float, and set friezes and soffits ...	,,	0 4½	0 7
Ditto, panelled and moulded	,,	0 11	1 5
Enriched friezes and soffits, extra only ...	,,	0 3½	1 2
Plain cornices and mouldings, above 6 in. girth	,,	0 11¼	1 3
Enrichments to ditto, 1 in. girth	per ft. run	0 3½	0 4
2-in. roll	,,	0 5	0 7
Quirk	,,	0 1	0 1½
Bead and quirk, under 2 in. girth ...	,,	0 1¼	0 2
,, double quirk, ditto	,,	0 2	0 3
Staff bead, 1½ in. to 3 in. girth, and double quirk	,,	0 3¼	0 4
Stops and mitres to quirks...	each	0 1	—
,, ,, to bead and quirk ...	,,	0 1¼	—
,, ,, ,, and double quirk	,,	0 2	—
,, ,, to staff bead and double quirk	,,	0 3¼	—

Stops and mitres are priced at the value of 1 foot run of the cornice, moulding, or bead, &c.

Cornices, Mouldings, Skirtings, &c., in Portland Cement.

		Straight. s. d.	Curved. s. d.
Plain cornices and mouldings, above 9 in. girth	per ft. sup.	0 10	1 2
Ditto, 6 in. to 9 in. ditto	per ft. run	0 8	0 11
,, under 6 in. ,, ...	,,	0 6	0 9
Ogee cement base moulding, 3 in. ...	,,	0 5	0 8
Skirtings, 1 cement, 1 sand, 6 in. high, beaded or chamfered	,,	0 5	0 7
Ditto, 8 in. high, with bead moulding ...	,,	0 6	0 9
Reveals or margins, 4½ in.	,,	0 4½	0 7
,, ,, 9 in.	,,	0 6½	0 9
Moulded architraves, 6 in.	,,	0 9	1 0
Quirk	,,	0 1¼	0 2
Flush bead in cement dado	,,	0 1½	0 2
Staff bead, 1½ in. to 3 in. girth, and double quirk	,,	0 4	0 5

Calculate stops and mitres as before.

Parian or Keen's Cement.

(On Portland cement grounds).

		Straight. s. d.	Curved. s. d.
Render and float, 1 cement and 1 sand ...	per yd. sup.	3 6½	3 9
Trowel and set face of walls, hand floated	,,	1 0	1 6
Ditto, ditto, panelled soffit, square or splayed	per ft. sup.	1 10	2 6
Plain mouldings	,,	1 4	1 10
Moulded skirting, including mitres ...	,,	1 2	1 5
,, ,, ,, double faced	,,	1 6	1 8
Trowel and set margins, 3 in. wide and under	per ft. run	0 3	0 5
Arris	,,	0 2	0 3

Parian or Keen's Cement—*continued.*

		Straight. s.	d.	Curved. s.	d.
Chamfer, 3 in. wide	per ft. run	0	3	0	4
Rounded angle, 4 in. girth	,,	0	4	0	5
Bead and quirk, under 1½ in. girth ...	,,	0	3	0	4½
,, double quirk, ditto	,,	0	4½	0	7
Flush and staff bead, 3 in. girth, and double quirk	,,	0	5	0	8

Stops and mitres are worth 1 foot run of work.

Stucco.

		s.	d.	s.	d.
Bastard stucco, on brick	per yd. sup.	1	4	1	7
,, ,, on lath	,,	1	11	2	3
Trowelled stucco, on brick	,,	1	4	1	8
,, ,, on lath	,,	2	1	2	6
,, ,, on jambs and soffits ...	per ft. sup.	0	3	0	4
Reveals, 4½ in.	per ft. run	0	4	—	
,, 9 in.	,,	0	6	—	
Arris	,,	0	1½	0	2
Quirk	,,	0	1	0	1½
Bead	,,	0	3	0	5
Bead and double quirk	,,	0	4	0	6

Martin's Cement.

		s.	d.	s.	d.
Render on brick	per yd. sup.	1	6	1	10
Trowelled for pointing	,,	2	3	2	10
Render, float, and set, on lath	,,	3	3	4	1
Mouldings	per ft. sup.	1	7	1	10
Narrow margins	per ft. run	0	4	0	5
Plain skirting, 9 in. high	,,	0	5	0	5½

Limewhiting and Colouring.

		s.	d.
Cleaning or brooming down	per yd. sup.	0	0½
Scraping walls	,,	0	2
Wash and stop ditto	,,	0	1½
Limewhite, 1 coat	,,	0	1½
,, 2 coats	,,	0	2¼
,, if on ceiling or roof timbers, add ...	,,	0	0½
Whitening, with whiting and size, 1 coat	,,	0	1½
,, ,, ,, ,, 2 coats	,,	0	2½
Colouring in distemper, stone or buff, 1 coat ...	,,	0	1¾
,, ,, ,, 2 coats ...	,,	0	2½
,, ,, French grey, 1 coat ...	,,	0	2½
,, ,, ,, 2 coats ...	,,	0	3
Clearcolle (or size), 1 coat, on plastered walls and ceilings	,,	0	0¾
Scrape, wash, and stop plain cornices	,,	0	3¾
Whitening to plain cornices, with whiting and size, 1 coat	,,	0	2¼
,, ,, ,, ,, ,, 2 coats	,,	0	3½
Coating external brickwork with solid paraffin and naphtha	,,	0	6
Colouring with Duresco, 1 coat, general surfaces ...	,,	0	2½
,, ,, ,, ,, plain cornices ...	,,	0	4
,, ,, ,, 2 coats, general surfaces ...	,,	0	4
,, ,, ,, ,, plain cornices ...	,,	0	5½

Centre Pieces.

		s.	d.
Ornamental papier-mâché centre pieces, 12 in. diameter, and fixed	each	20	0
,, ,, ,, ,, 18 in. ,,	,,	35	0
,, ,, ,, ,, 24 in. ,,	,,	45	0
,, ,, ,, ,, 30 in. ,,	,,	55	0
Scrape, wash, stop, and whiten and size, 2 coats, 12 in. diam.	,,	0	7
,, ,, ,, ,, ,, ,, 18 in. ,,	,,	0	8
,, ,, ,, ,, ,, ,, 24 in. ,,	,,	0	9
,, ,, ,, ,, ,, ,, 30 in. ,,	,,	0	10

Miscellaneous.

Raking out mortar joints of old brickwork, washing, &c.	per yd. sup.	0	7
,, cement ,, ,, ,, ,,	,,	0	10
Taking down old rendering, lathing, and plastering, and removing the old materials off the premises ...	,,	0	3
Ditto, ditto, in cement work	,,	0	5
Hacking off plastering	,,	0	2
,, cement work...	,,	0	3½
Rough casting, lime, 2 coats	,,	0	8½
Fibrous plaster slabs, ⅝ in. thick, for ceilings and walls, s.o.	,,	1	4
Jhilmil patent metal lathing, s.o.	,,	1	0
Expanded fireproof ,, s.o.	,,	0	10
Pugging to floors, 2 in. thick (the net quantity between the joists being measured)	,,	0	6
Ditto, 3 in. thick (ditto, ditto)	,,	0	9
Chimney openings rendered and set	each	2	0

Materials.

(supplied only.)

Alum	per lb.	0	1½
Brushes, limewhite	each	2	9
,, stock, for colouring...	,,	5	9
Cement, Keen's coarse	per bushel	3	0
,, ,, fine	,,	5	0
,, Parian, coarse	,,	3	0
,, ,, fine	,,	5	0
,, Portland	,,	1	10
, Roman	,,	1	9
,, Martin's, cost in London	per cwt.	5	0
,, ,, ,, Derby	,,	4	3
Chloride of lime	per lb.	0	5
Duresco	per cwt.	30	0
Petrifying liquid for ditto	per gal.	2	6
Glue, good, bright, for plasterer's work only ...	per lb.	0	3½
Gravel, clean	per yd. cube	6	6
Hair, bullocks'	per cwt.	8	6
Laths, split, fir, double	per bundle	3	0
,, ,, ,, lath and half	,,	2	4
,, ,, ,, single	,,	1	6

Materials—*continued.*		s.	d.
Lime, unslaked, ground fine, stone, best grey Dorking	per yd. cube	11	0
,, ,, ,, ,, ,,	per bushel	0	$8\frac{1}{4}$
,, ,, ,, ,, white chalk	,,	0	$7\frac{1}{4}$
Grinding lump lime, labour only	per yd. cube	1	0
Mastic	per cwt.	5	0
Mortar, stone or grey chalk lime, 1 to 3	per yd. cube	16	0
,, ,, ,, ,, ,, ...	per ft. cube	0	7
,, hair ,, ,, ,, ...	per yd. cube	17	10
,, ,, ,, ,, ,, ...	per ft. cube	0	8
,, Portland cement, 1 to 2	per yd. cube	33	9
,, ,, ,, ,, ...	per ft. cube	1	3
,, ,, ,, 1 to 3	per yd. cube	25	0
,, ,, ,, ,, ...	per ft. cube	0	11
Nails, cast, for laths	per lb.	0	$1\frac{1}{2}$
,, wrought, for laths	,,	0	$2\frac{1}{2}$
Naphtha spirit	per gal.	3	6
Paint, dry, blue-black	per lb.	0	1
,, ,, ivory black	,,	0	$1\frac{1}{2}$
,, ,, lamp black	,,	0	2
,, ,, blue, Prussian	,,	3	0
,, ,, ,, ultramarine...	,,	1	0
,, ,, green copperas	,,	0	1
,, ,, ochre	,,	0	$1\frac{1}{4}$
,, ,, raw umber...	,,	0	$1\frac{1}{4}$
,, ,, Vandyke brown	,,	0	$7\frac{1}{2}$
,, ,, Venetian red	,,	0	2
Plaster of Paris, coarse	per cwt.	2	9
,, ,, fine	,,	3	9
Potash	per lb.	0	6
Putty for stopping	per ft. cube	0	9
Sand, pit or river, clean sharp, unwashed	per yd. cube	6	9
,, ,, ,, washed	,,	10	0
,, ,, ,, washing, labour only	,,	1	7
,, ,, ,, screening	,,	0	$6\frac{1}{2}$
,, sea, washed and dried	,,	7	0
Size, best quality	per lb.	0	3
,, best, extra double	per cwt.	40	0
Soda	,,	6	0
Sulphate of copper	per lb.	0	5
Tallow, Russian	,,	0	6
Wax for moulds	,,	3	6
Whiting, best washed, in lumps	per cwt.	2	4
,, ,, ,, ...	per lb.	0	$0\frac{1}{4}$
Wages, plasterer's	per hour	0	11
,, labourer's	,,	0	7
,, boy's	,,	0	$4\frac{1}{2}$
,, modeller's	,,	1	3

ANALYSIS.

Materials.

Coarse stuff is a rough mortar, containing 1 part of lime to 2 parts of sand, mixed with hair in the proportion of 1 lb.

of hair to every 2 c. ft. of mortar for good work, or 1 lb. to every 3 c. ft. for ordinary work. Sometimes the hair is specified to be in the proportion of 1 lb. of hair to every bushel of unslaked lime.

Fine Stuff is pure lime slaked with a small quantity of water, and afterwards diluted to the consistency of cream. It is then allowed to harden by evaporation until thick enough for use. A small quantity of white sand, and sometimes white hair, is added.

Plasterer's Putty is lime dissolved in water, and then run through a hair sieve. It is very similar to fine stuff, but prepared somewhat differently, and always used without hair.

Gauged Stuff, called "putty and plaster," is composed of 3 to 4 parts of plasterer's putty, and the remainder plaster of Paris, in proportion regulated by the rapidity required in hardening. The plaster of Paris causes the mixture to set very quickly. For cornices, the putty and plaster are mixed in equal proportions.

Lime.—The pure (*i.e.*, rich or fat) limes are generally employed for plastering, because in using hydraulic limes, minute unslaked particles are apt to get into the work, and to "blow," throwing out bits of plaster and injuring the surface. This pure lime should be run into putty some time before it is required, and the sand that is to be used should be perfectly clean and free from impurities. When converted into lime putty, stone lime increases one-fourth in bulk.

Mixing fine stuff or putty would probably require about one-fourth more time than mixing lime and hair, and the labour for setting with gauged stuff would be considerably more than setting with fine stuff.

For details of purchase see "Excavator."

Sand.—See "Excavator." "Good sand for lime plaster should be hard, sharp, gritty, and free from all organic matter. Good sand for plaster work may be rubbed between the hands without soiling them. For coarse stuff and for cement for floating coats it should not be too fine. Fine-grained sand is best for hydraulic limes, and the coarse-grained for fat limes.

"Sand should not be uniform in size, but, like the aggregate for concrete, should vary in size and form of grain. A composition of fine and coarse sand for coarse stuff, unless the sand is naturally so mixed, gives the best results; for as the lime will receive more sand in that way without losing its plasticity, it will make a harder and stronger material,

whether coarse stuff, setting stuff, or for Portland-cement work.

"Silver sand is used for Portland-cement work when a light colour and a fine texture is required. It is chiefly obtained at Leighton Buzzard."—MILLAR, on "Plastering."

Hair.—The hair for plastering should be ox-hair, but it is sometimes adulterated with the short hair of horses. It is generally obtained from plasterers'-hair merchants, in a dry state in bags or bundles, but foreign hair is cheaper than English. It should be dry and well beaten before use, but hair fresh from the tanner's yard, in a wet state, makes the best work, as it is much stronger, and mixes freely. Coarse stuff for first coating on lath-work requires more hair than for brick or stonework. When coarse stuff is made in a mill, the hair should not be added until the stuff is ground, as excessive grinding weakens it.

A bushel of dry hair weighs about 14 lb., and is classed according to quality as Nos. 1, 2, and 3, the latter being the best.

For Hair Mortar, see "*Bricklayer.*"

Lathing.—Laths come chiefly from Memel and other Baltic ports. They should be free from knots and splits. Those split by hand give the best results, as they rend in a line with the grain of the wood, and are therefore generally stronger, and are not so liable to twist as the machine-made ones. Machine or sawn laths are superseding hand-made ones, but there is no comparison between the two. The former look much stronger than they really are; but they are very weak. The latter are cloven entirely along with the grain, thus guaranteeing the maximum strength and resilience.

Cast-iron nails are used for common work, wrought nails in high-class work. Zinc and galvanised-iron nails have been introduced to prevent rusting. French wire nails are the best, and do not break. For lath and half they should be 1 in. long, and 900 weigh 1 lb.

As regards metal lathing, there are several kinds. Jhilmil patent metal lathing is kept in sheets 5 ft. × 2 ft., 5 ft. × 1 ft. 6 in., and 5 ft. × 1 ft. The price is 1*s.* per yard super., supplied only. Expanded metal lathing has been introduced from America, and is principally used for fireproofing. The Bostwick patent fireproof metal lathing is also an American invention, and has been employed in England.

Portland Cement.—For full particulars of purchase, &c., see "Excavator."

Plaster of Paris.—This is made from calcined gypsum, which is a sulphate of lime. It is found in immense quantities in Montmartre, near Paris—hence its name. In this country it is found in Derbyshire, Cheshire, Nottingham, Cumberland, and Westmorland. Gypsum is got by blasting; it is then boiled or baked, and afterwards ground. The finest is called "alabaster," and is soft, pure in colour, and fragile.

When mixed with water to form a paste, plaster of Paris sets very quickly, expanding as it sets, and attains its full strength in an hour or two. Hence in running cornices, &c., lime putty is added. In the English trade, plaster of Paris is known simply as "plaster."

Roman Cement.—A hydraulic cement was patented by Mr. Parker, of London, in 1796, which he called Roman cement, probably from its dark colour, resembling that of mortar found in Roman buildings. It is made from the septaria nodules of the London clay formation found in the Isle of Sheppey. The septaria of Harwich also produced a cement of the same nature. Roman cement is a good material for quick setting, and very useful for repairing jobs. It will also receive paint almost as soon as finished, while Portland cement takes several months. Its quick-setting properties necessitate a great amount of skill and attention on the part of the workman, and it must be applied as soon as gauged.

Roman cement weighs 70 lb. to 80 lb. per bushel. It will not carry more than two parts of sand or other aggregate, and it has only one-third the strength of Portland. Other varieties of Roman cement are Sheppey, Medina, and Atkinson's cements.

Parian and Keen's Cements.—These cements are somewhat alike in make, and have similar qualities. Parian cement was patented in 1846, and consists of gypsum immersed in a solution of borax, cream of tartar, and water, then calcined and ground. It is so called on account of its likeness to Parian marble. It works more freely than either Keen's or Martin's, and sets quickly and hard. Keen's cement was patented in 1838, and consists of soaking plaster of Paris in a solution of 1 part of alum to 12 parts of water at a temperature of 95°, and then carefully ground.

Both cements have quick-setting properties, and give a hard, non-porous surface, capable of taking a fine polish. They are largely used for indoor work, and can be painted on or papered within a few hours of being finished. There

are three qualities of manufacture—coarse, fine, and superfine. The last is quite white. The backing or rendering coat should be formed of Portland cement. The next coat is of Parian or Keen's cement and sand, about $\frac{1}{2}$ in. thick, and the finishing coat of neat similar cement.

Martin's Cement was the first white cement of a reliable nature having gypsum for its basis, and was invented in 1834. It consists of an admixture of alkali (pearl ash) and acid with gypsum. The cement is of a creamy colour, and sets very hard. It is chiefly used for walls, dadoes, and skirtings, and can be painted on in a few hours. There are three qualities—coarse, fine, and superfine.

Fibrous Plaster consists of fine plaster of Paris cast in suitable moulds, and laid on canvas backing, which is fixed to a wooden framework. It was patented in 1856 by a French modeller. It is specially used for panelled ceilings, centre flowers, and other surface decorations. Fibrous plaster slabs, $\frac{1}{2}$ in. thick, weigh $2\frac{1}{4}$ lb. per foot super., and 14 lb. of nails will fix 100 yards super.

Rendering with Haired Mortar.

The statements given by textbooks as to the various quantities of material and amounts of labour required for certain quantities of work are most conflicting. In some cases they are certainly wrong, and it is obvious that the authors have simply cribbed from other sources without the slightest effort to ascertain if their amounts, &c., are feasible, if measures tally with weights, &c., as well as other glaring inconsistencies. It will generally be found that Seddon is reliable for quantities of stuff, and Hurst for constants of labour, as the figures given by these writers are from actual experience. They have, however, been somewhat modified in this chapter, according to the author's own observations. Very rough or uneven walls will make some difference in the quantity of rendering material. (See "Memoranda" for proportions of stuff, &c.)

Rendering, one Coat.—As it is impracticable to work out an analysis from the minute quantities required for a single square yard, it is found advisable to show the stuff and labour necessary for some large area (such as 100 yards), and then divide, in order to arrive at a fair calculation for a unit. The quantities and labour given below are for 100 yards super. of rendering, 1 coat $\frac{3}{8}$ in. thick, which dimensions are about equal to a cubic yard. Specified proportions

are 1 lime to 2 sand, with 1 lb. hair per bushel of lime. As there are 16 bushels of lime per yard cube, this gives 16 lb. of hair to the yard cube.

	£	s.	d.
1 yard cube unslaked lime at 11*s.*	0	11	0
2 yards cube washed sand, at 10*s.*	1	0	0
$\frac{16}{112}$ cwt. hair at 8*s.* 6*d.*	0	1	2½
Water, 100 gal. at, say, 1*d.* per 25 gal.	0	0	4
Labour, 18 hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*)	1	7	0
	2	19	6½
Add 15 per cent. profit	0	9	11½
100)	3	9	6
Price per yard super.	0	0	8¼

Render, 1 Coat, and set with Fine Stuff.—This would be ½ in. thick, and the hair would mostly be in the rendering, or, say, 25 lb. in all. The detailed cost would be—

	£	s.	d.
2 yards cube unslaked lime at 11*s.*	1	2	0
2 ,, washed sand at 10*s.*	1	0	0
$\frac{25}{112}$ cwt. hair at 8*s.* 6*d.*	0	1	11
Water, 200 gal. at 1*d.* per 25 gal.	0	0	8
Labour, 27 hours, at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*)	2	0	6
	4	5	1
Add 15 per cent. profit	0	12	9
100)	4	17	10
Price per yard super.	0	1	0

Render, float, and set with Fine Stuff.—The thickness is ¾ in., and the quantities are increased as shown as follows:—

	£	s.	d.
2⅓ yards cube unslaked lime at 11*s.*	1	5	8
2⅓ ,, washed sand at 10*s.*	1	3	4
$\frac{30}{112}$ cwt. hair at 8*s.* 6*d.*	0	2	3½
Water, 250 gal. at 1*d.* per 25 gal.	0	0	10
Labour, 45 hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*)	3	7	6
	5	19	7½
Add 15 per cent. profit	0	17	11½
100)	6	17	7
Price per yard super.	0	1	4½

Lathing and Plastering.

Of this there are virtually three kinds of work, each including the common groundwork of lathing :—

One-coat work.—Lath and plaster, 1 coat.
Two-coat work.—Lath, plaster, and set (with fine stuff, plasterer's putty, or gauged stuff).
Three-coat work.—Lath, plaster, float, and set (with fine stuff, plasterer's putty, or gauged stuff).

Lathing only, Lath and Half.—The terms and quantities for lathing are also very indefinite. A bundle of laths contains 360 ft. to 500 ft. run, and the lengths vary from 3 ft. to 5 ft., increasing 6 in. at a time. The number in a bundle therefore varies, London style. The original lath-splitters make up 500 ft. in a bundle; but the merchants frequently have them remade into bundles of a less quantity. The standard bundle consists of 100 laths; but for every 6 in. less than 4 ft. in length an additional 10 laths per bundle is allowed. For example :—

Laths,	3 ft. long,	contain	120	per bundle	360 ft. run.
,,	$3\frac{1}{2}$ ft. ,,	,,	110	,,	385 ft. ,,
,,	4 ft. ,,	,,	100	,,	400 ft. ,,
,,	$4\frac{1}{2}$ ft. ,,	,,	100	,,	450 ft. ,,
,,	5 ft. ,,	,,	100	,,	500 ft. ,,

A plasterer generally says 100 laths constitute a bundle, and the quantity differs more in the provinces than in London. It is a good thing, when ordering, to state the number of feet run expected in a bundle, which is supposed to cover $4\frac{1}{2}$ yards super.

A lath 3 ft. long is the most suitable when the joists are the customary 2 in. thick and 1 ft. apart, centre to centre. But if the joists are spaced 1 ft. apart in the clear, then laths 3 ft. 6 in. long are the proper size. (See Figs. 43 and 44.)

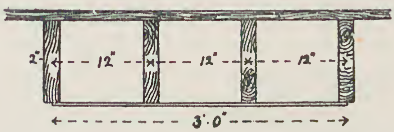

Fig. 43.—Joists spaced 12 in. Centre to Centre.

Taking 360 ft. total in a bundle, with 3 ft. as a common length, this would give 120 laths per bundle (the number in a bundle varying with size of lath). As the laths are 1 in. wide and $\frac{3}{8}$ in. apart, a bundle will apparently cover nearly

five yards super., but allowing 10 per cent. for waste, the real surface is $4\frac{1}{2}$ yards. By actual counting when laths are up the writer has found that 1 yard super. requires 24 laths 3 ft. long, and 21 laths 3 ft. 6 in. long. The joists being 1 ft. apart, four nails (one at each joist) per lath will be needed (120 laths × 4 nails), or 480 per bundle. As $\frac{7}{8}$ in. wrought nails would be used for lath and half, and as 850 run to the lb., about $\frac{5}{8}$ lb. would be required per bundle,

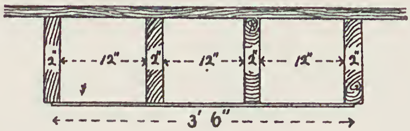

FIG. 44.—Joists spaced 12 in. in clear.

allowing for waste. Wrought nails are best, as they do not break.

A plasterer and boy can nail 1 yard super. of lath and half in $\frac{1}{5}$th hour, or say $4\frac{1}{2}$ to 5 yards per hour. Some plasterers boast that they can put up a bundle of laths in an hour, but this is very exceptional; $\frac{3}{4}$-bundle per hour is a fairer average.

Laths are sold by the lath-splitters at 15*s.* per thousand, or 1*s.* 10*d.* per bundle, prime cost. Rail, cartage, &c., will bring this up to 2*s.* 4*d.* Lath-splitting is a trade in itself, the splitters purchasing their timber from timber merchants by the cubic fathom. Of course, laths are also obtained at the sawmills.

	s.	*d.*
One bundle (360 ft.) laths, lath and half	2	4
$\frac{5}{8}$ lb. wrought nails, at $2\frac{1}{2}$*d.*	0	$1\frac{1}{2}$
Labour, 1 hour at 1*s.* $3\frac{1}{2}$*d.* (plasterer, 11*d.*; boy, $4\frac{1}{2}$*d.*)	1	$3\frac{1}{2}$
	3	9
Add 15 per cent. profit	0	7
	$4\frac{1}{2}$)4	4
Price per yard super.	0	$11\frac{1}{2}$

Scaffolding.—In plastering allow $\frac{1}{4}$*d.* per yard super. for each of the four operations of lath, render, float, and set, for fixing scaffolding for plasterers to work from = 1*d.* total per yard super. for labour in fixing scaffolding.

Lath and Plaster, one Coat.—This is practically "rendering, one coat," laid on "lathing only," and it should be sufficient to merely add the two prices together, though the first or

"pricking up" coat on laths requires one-tenth more coarse stuff than "rendering."

	s.	d.
Lathing only	0	11½
Rendering, one coat	0	8¼
Price per yard super.	1	7¾

By an actual test the author has found that 6½ cubic feet of coarse stuff will cover 10 yards super, one coat, on lathing, and take 1¼ hours plasterer and labourer.

Lath, Plaster and Set.—The "setting" is a thin layer of fine stuff, plasterer's putty, or gauged stuff, and one of these finishes should be definitely stated. We will here take fine stuff, as the most common. The following materials and labour will be required for 100 yards :—

	£	s.	d.
22 bundles laths (lath and half) at 2*s.* 4*d.*	2	11	4
14 lb. wrought nails, at 2½*d.*	0	2	11
2 yards cube unslaked lime, at 11*s.*	1	2	0
2 ,, ,, washed sand, at 10*s.*	1	0	0
$\frac{28}{112}$ cwt. hair, at 8*s.* 6*d.*	0	2	1½
Water, 220 gal., at 1*d.* per 25 gal.	0	0	8½
Labour, 45 hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*)	3	7	6
	8	6	7
Add 15 per cent. profit	1	5	0
	100)9	11	7
Price per yard super.	0	1	11

Lath, Plaster, Float, and Set.—As in last item, the setting should be definitely described, and fine stuff will again be considered. The method of analysis is similar, and 100 yards area is taken :—

	£	s.	d.
22 bundles laths (lath and half), at 2*s.* 4*d.*	2	11	4
14 lb. wrought nails, at 2½*d.*	0	2	11
2½ yards cube unslaked lime, at 11*s.*	1	7	6
2½ ,, ,, washed sand, at 10*s.*	1	5	0
$\frac{32}{112}$ cwt. hair, at 8*s.* 6*d.*	0	2	5¼
Water, 270 gal., at 1*d.* per 25 gal.	0	0	10¾
Labour, 60 hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*)	4	10	0
	10	0	1
Add 15 per cent. profit	1	10	0
	100)11	10	1
Price per yard super.	0	2	3½

Rendering with Portland Cement.

The shrinkage for cement and sand is one-sixth (17 per cent.); but the actual quantities required to cover certain areas will be found in "Memoranda." As sand is sold by the yard cube, and not by the bushel, the former measure will be found more convenient for it. There are 21 bushels of sand in a yard cube. The usual thickness for Portland cement and sand rendering is $\frac{3}{4}$ in., which should be performed in one operation; but $\frac{1}{2}$ in. thick is sufficient for neat cement.

Render with Pure Portland Cement $\frac{1}{2}$ in. thick.—A bushel of cement will cover 2·8, or say $2\frac{3}{4}$, yards super., $\frac{1}{2}$ in. thick, and a plasterer and labourer will take $1\frac{3}{4}$ hours to work them.

	s.	d.
1 bushel Portland cement	1	10
Water, about 3 gal.	0	0
Labour, $1\frac{3}{4}$ hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*) ...	2	$7\frac{1}{2}$
	4	$5\frac{1}{2}$
Add 15 per cent. profit	0	8
	$2\frac{3}{4}$)5	$1\frac{1}{2}$
Price per yard super.	1	10

Render and Float, $\frac{3}{4}$ in. thick, with 1 *Cement to* 1 *Sand.*—A bushel of cement and a bushel (or $\frac{1}{21}$ yard cube) of sand will cover $3\frac{1}{3}$ yards super. $\frac{3}{4}$ in. thick. The time will be $2\frac{1}{4}$ hours plasterer and labourer.

	s.	d.
1 bushel Portland cement	1	10
$\frac{1}{21}$ yard cube washed sand, at 10*s.*	0	$5\frac{1}{2}$
Water, about 5 gal.	0	0
Labour, $2\frac{1}{4}$ hours at 1*s.* 6*d.* (plasterer, 11*d.*; labourer, 7*d.*) ...	3	$4\frac{1}{2}$
	5	8
Add 15 per cent. profit	0	10
	$3\frac{1}{3}$)6	6
Price per yard super.	1	11

Ditto with 1 *Cement to* 2 *Sand.*—A bushel of cement and 2 bushels ($\frac{2}{21}$ yard cube) of sand will cover $4\frac{3}{4}$ yards super. $\frac{3}{4}$ in. thick. The time required will be a little more.

	s.	d.
1 bushel Portland cement	1	10
$\frac{2}{21}$ yard cube washed sand, at 10*s*.	0	$10\frac{1}{2}$
Water, about 7 gal.	0	0
Labour, $2\frac{3}{4}$ hours at 1*s*. 6*d*. (plasterer and labourer)	4	$1\frac{1}{2}$
	6	10
Add 15 per cent. profit	1	0
	$4\frac{3}{4}$)7	10
Price per yard super.	1	8

Ditto with 1 *Cement to* 3 *Sand.*—With these proportions a bushel of cement and 3 bushels ($\frac{3}{21}$ yard cube, of sand will cover $6\frac{1}{2}$ yards super. $\frac{3}{4}$ in. thick. The labour will be 3 hours.

	s.	d.
1 bushel Portland cement	1	10
$\frac{3}{21}$ yard cube washed sand, at 10*s*.	1	5
Water, about 7 gal.	0	0
Labour, 3 hours at 1*s*. 6*d*. (plasterer and labourer)	4	6
	7	9
Add 15 per cent. profit	1	2
	$6\frac{1}{2}$)8	11
Price per yard super.	1	$4\frac{1}{2}$

Cornices, Mouldings, etc., in Plaster.

Plain Cornices and Mouldings above 6 *in. Girth.*—These are usually measured by the foot super., but the price will vary immensely, according to the pattern. The plaster of Paris used in running cornices has lime putty mixed with it in an equal proportion to keep it from setting too quickly, and to make it work more freely. The labour includes moulds and preparation, and will differ greatly.

	s.	d.
Material, $\frac{1}{8}$ yard super. at 6*d*.	0	$0\frac{3}{4}$
Labour, $\frac{1}{2}$ hour at 1*s*. 6*d*. (plasterer and labourer)	0	9
	0	$9\frac{3}{4}$
Add profit	0	$1\frac{1}{2}$
Price per foot super.	0	$11\frac{1}{4}$

Cornices may be priced at 1*d*. per foot run per inch girth—6-in. girth 6*d*., and so on. Stops and mitres are priced at the value of one foot run of the cornice or moulding.

Quirk.—A plasterer will execute a yard run in one-fifth of an hour.

	s.	d.
$\frac{1}{5}$ hour plasterer, at 11*d.*	3)0	$2\frac{1}{4}$
Price per foot run, including profit	0	1

Bead and Quirk, under 2 *in. Girth.*—A plasterer will do a yard run in three-tenths of an hour.

	s.	d.
$\frac{3}{10}$ hour plasterer, at 11*d.*	3)0	$3\frac{1}{4}$
Price per foot run, including profit	0	$1\frac{1}{4}$

Cornices, Mouldings, Skirtings, etc., in Portland Cement.

Skirtings, 1 *Cement,* 1 *Sand,* 6 *in. high, Beaded or Chamfered.*—This would be $\frac{3}{4}$ in. thick, and the value can be deduced from the item for "Render and float $\frac{3}{4}$ in. thick, with 1 cement to 1 sand," already given. The material in a foot run of this skirting would be $\frac{1}{18}$ yard super.

	s.	d.
Material, $\frac{1}{18}$ yard super. at 9*d.*	0	$0\frac{1}{2}$
Labour, $\frac{1}{4}$ hour plasterer, at 11*d.*	0	$2\frac{3}{4}$
Labour to bead, $\frac{1}{10}$ hour ditto	0	1
	0	$4\frac{1}{4}$
Add profit	0	$0\frac{3}{4}$
Price per foot run	0	5

Stops and mitres are reckoned as for cornices and mouldings—the value of a foot run of skirting.

Quirk.—A plasterer will do a yard run in $\frac{3}{10}$ hour.

	s.	d.
$\frac{3}{10}$ hour plasterer, at 11*d.*	3)0	$3\frac{1}{4}$
Price per foot run, including profit	0	$1\frac{1}{4}$

Parian or Keen's Cement.

Render and Float, 1 *Cement and* 1 *Sand.*—Parian and Keen's cement, being similar, are the same in price. For surface work both are laid on Portland cement grounds. Four bushels of Parian cement and 4 bushels ($\frac{4}{21}$ yard cube) of sand will cover 10 yards super. $\frac{1}{2}$ in. thick. The

labour is about the same as that required for Portland cement.

	£	s.	d.
4 bushels Parian cement, fine, at 5s.	1	0	0
$\frac{4}{27}$ yard cube washed sand at 10s.	0	1	11
Water, about 12 gallons	0	0	0
Labour, 6 hours at 1s. 6d. (plasterer and labourer)	0	9	0
	1	10	11
Add 15 per cent. profit	0	4	7
	10)1	15	6
Price per yard super.	0	3	$6\frac{1}{2}$

Limewhiting and Colouring.

Limewhite, one Coat.—Limewhite or whitewash consists of any common fat lime, such as chalk lime, mixed with water, applied to walls and ceilings, chiefly for sanitary purposes. Green copperas may be added to colour it buff. A little tallow is added for binding. From 1 to $1\frac{1}{2}$ ft. cube (say 1 bushel) of slaked lime in powder, and $\frac{3}{4}$ lb. tallow, will cover 100 yards super., one coat. A plasterer and labourer will take six hours to go once over this surface.

	s.	d.
1 bushel lime at $7\frac{1}{4}d.$...	0	$7\frac{1}{4}$
Water, about 10 gal.	0	0
$\frac{3}{4}$ lb. Russian tallow at 6d.	0	$4\frac{1}{2}$
Labour, 6 hours at 1s. 6d. (plasterer and labourer)	9	0
	9	$11\frac{3}{4}$
Add 15 per cent. profit	1	$5\frac{1}{4}$
	100)11	5
Price per yard super.	0	$1\frac{1}{2}$

If no attendant labourer was required the price would work out to 1d. per yard super. In the War Department soldiers are often employed to perform plain limewhiting, and a man is supposed to do 80 to 100 yards per day.

Ditto, two Coats.—From $1\frac{2}{3}$ to 2 ft. cube (say $1\frac{1}{2}$ bushel) of lime, and $1\frac{1}{4}$ lb. tallow, will cover 100 yards super., two coats. Nearly double labour will be required.

	s.	d.
$1\frac{1}{2}$ bushel lime at $7\frac{1}{4}d.$	0	$10\frac{3}{4}$
Water, about 17 gal.	0	0
Carried forward	0	$10\frac{3}{4}$

	s.	d.
Brought forward	0	10$\frac{3}{4}$
1$\frac{1}{4}$ lb. Russian tallow at 6*d*....	0	7$\frac{1}{2}$
Labour, 10 hours at 1*s*. 6*d*. (labourer and plasterer)	15	0
	16	6$\frac{1}{4}$
Add 15 per cent. profit	2	5$\frac{3}{4}$
	100)19	0
Price per yard super.	0	2$\frac{1}{4}$

Whitening, with Whiting and Size, one Coat.—Whiting is pure chalk ground to a fine powder, chiefly used with water and size to plastered ceilings and walls. It is not durable for external work. 12 lb. whiting, $\frac{1}{2}$ lb. blue-black, and 1$\frac{3}{4}$ gal. size, will cover 100 yards super., one coat. Glue, 1$\frac{3}{4}$ lb., may be substituted for the size (1 lb. of glue making a gallon of size), as the latter is really thin liquid glue. The time will be seven hours of plasterer and labourer.

	s.	d.
12 lb. whiting at $\frac{1}{4}$*d*....	0	3
$\frac{1}{2}$ lb. blue-black at 1*d*.	0	0$\frac{1}{2}$
1$\frac{3}{4}$ lb. glue at 3$\frac{1}{2}$*d*.	0	6
Water, about 10 gal....	0	0
Labour, 7 hours at 1*s*. 6*d*. (plasterer and labourer)	10	6
	11	3$\frac{1}{2}$
Add 15 per cent. profit	1	8$\frac{1}{2}$
	100)12	0
Price per yard super.	0	1$\frac{1}{2}$

Ditto, 2 Coats.—21 lb. whiting, $\frac{3}{4}$ lb. blue-black, and 2$\frac{3}{4}$ gal. size will cover 100 yards super., 2 coats. Glue, 2$\frac{3}{4}$ lb., may be substituted for the size as before. Allow twelve hours for labour.

	s.	d.
21 lb. whiting at $\frac{1}{4}$*d*....	0	5$\frac{1}{4}$
$\frac{3}{4}$ lb. blue-black at 1*d*.	0	0$\frac{3}{4}$
2$\frac{3}{4}$ lb. glue at 3$\frac{1}{2}$*d*.	0	9$\frac{1}{2}$
Water, about 17 gal....	0	0
Labour, 12 hours at 1*s*. 6*d*. (plasterer and labourer)	18	0
	19	3$\frac{1}{2}$
Add 15 per cent. profit	2	10$\frac{1}{2}$
	100)22	2
Price per yard super.	0	2$\frac{1}{2}$

Colouring in Distemper, Stone or Buff, 1 *Coat*.—10 lb. whiting, 3 lb. ochre, ½ lb. umber, and 2 gal. size (substitute 2 lb. glue) will cover 100 yards super., 1 coat. Labour, eight hours.

	s.	*d.*
10 lb. whiting at ¼*d.*	0	2½
3 lb. ochre at 1¼*d.*	0	3¾
½ lb. umber at 1½*d.*	0	0¾
2 lb. glue at 3½*d.*	0	7
Water, about 10 gal.	0	0
Labour, 8 hours at 1*s.* 6*d.* (plasterer and labourer)	12	0
	13	2
Add 15 per cent. profit	1	11
100)	14	1
Price per yard super.	0	1¾

Ditto, French Grey, 1 *Coat*.—This is a "superior colour." 12 lb. whiting, 1½ lb. Prussian blue, and 2¼ gal. size (substitute 2¼ lb. glue) will cover 100 yards super., 1 coat. Labour, eight hours.

	s.	*d.*
12 lb. whiting at ¼*d.*	0	3
1½ lb. Prussian blue at 3*s.*	4	6
2¼ lb. glue at 3½*d.*	0	8
Water, about 10 gal.	0	0
Labour, 8 hours at 1*s.* 6*d.* (plasterer and labourer)	12	0
	17	5
Add 15 per cent. profit	2	7
100)	20	0
Price per yard super.	0	2½

Miscellaneous.

Raking out Mortar Joints of old Brickwork, Washing, &c.—This includes forming key for rendering, brushing and saturating walls to receive plaster. As the work will mostly be done from a scaffold, the time for erecting and removing this must be taken into account. A plasterer and labourer will then be able to do 3 yards per hour.

	s.	*d.*
1 hour (plasterer and labourer)	1	6
Add profit	0	2½
3)	1	8½
Price per yard super.	0	7

For cement joints the labour will be half as much again, or 10*d*. per yard super. total.

Rough Casting, 2 *Coats*.—For rough casting, 20 bushels lime, 2 yards cube sand, 16 lb. hair, and $\frac{3}{4}$ yard cube gravel for the dash coat, will cover 100 yards super., 2 coats. Labour will be fifteen hours plasterer and labourer.

	£	*s.*	*d.*
20 bushels lime at $7\frac{1}{4}$*d.*	0	12	1
2 yards cube washed sand at 10*s.*	1	0	0
$\frac{16}{112}$ cwt. hair at 8*s.* 6*d.*	0	1	$2\frac{1}{2}$
$\frac{3}{4}$ yard cube gravel at 6*s.* 6*d.*	0	4	$10\frac{1}{2}$
Labour, 15 hours at 1*s.* 6*d.* (plasterer and labourer)... ...	1	2	6
	3	0	8
Add 15 per cent. profit	0	9	1
100)	3	9	9
Price per yard super.	0	0	$8\frac{1}{2}$

To colour the above, add 5 lb. copperas for buff, and 1 lb. fresh cow-manure, strained and mixed with the liquid dash. The addition of 10 per cent. of alum solution will give brilliancy and permanency to the colours.

CHAPTER XVII.—PAINTER.

MEMORANDA.

BUILDINGS should be painted externally once every four years; internally, every eight years.

1 ft. cube of white-lead ground in oil	... ...	weighs	252 lb.
,, ,, ,, dry	... ...	,,	400 lb.
,, coal-tar	... ...	,,	63 lb.
One gallon of linseed-oil	... ...	,,	9 lb.
,, turpentine	... ...	,,	9 lb.
,, coal-tar	... ...	,,	10 lb.
,, pitch	... ...	,,	11 lb.
,, special paint	... ...	,,	25 lb.
One barrel of turpentine	... ...	equals	36 gal.
,, wood tar	... ...	,,	30 gal.

1 lb.	ready-mixed paint	covers on	wood	4 yd. super.	1st coat.
,,	,,	,,	,,	6 yd. ,,	2nd ,,
,,	,,	,,	,,	7 yd. ,,	3rd ,,
,,	,,	,,	,,	7 yd. ,,	4th ,,
1 gal.	,,	,,	stone	25 to 30 yds. super.	
,,	,,	,,	compo.	40 ,, 50 ,,	
,,	,,	,,	wood	50 ,, 70 ,,	
,,	,,	,,	iron	80 ,, 90 ,,	
,,	any special paint	,,	wood	100 ,, 110 ,,	
,,	Szerelmey stone liquid covers,			3 coats, 25 ,,	

1 lb. of glue makes 1 gal. of size.

PROPORTIONS OF MATERIALS.

The quantities of materials vary according to the surface to be painted on, and according to the ideas of the painter. Each succeeding coat covers a larger surface with the same quantity of paint than the previous one.

The following amounts (from "Notes on Building Construction," vol. iii.) per coat make about a gallon of paint, and cover 100 yards super. on new wrought deal.

These form white paint, to the last two coats of which various pigments may be added according to the colour required in the proportion of 1 to 2 oz. per 10 yards of surface to be painted, the quantity of white lead being reduced in proportion.

PROPORTIONS OF PAINTING MATERIALS.

Description.	Glue for Size.	Putty.	Pumice Stone.	Glass Paper.	Red Lead.	White Lead.	Raw Linseed Oil.	Boiled Linseed Oil.	Turps.	Driers.	Labour. — Painter.
To cover 100 yards super.—	lb.	lb.	lb.	quires.	lb.	lb.	gal.	gal.	gal.	lb.	hours.
Knotting	$\frac{1}{3}$	—	—	—	$\frac{1}{3}$	—	—	—	—	—	5
Stopping	—	4	$\frac{1}{2}$	1	—	—	—	—	—	—	5
INSIDE WORK.											
(Four coats not flatted.)											
1st coat, or priming........	—	—	—	—	$\frac{1}{2}$	16	$\frac{3}{4}$	—	—	$\frac{1}{4}$	16
2nd ,, ...	—	—	—	—	—	15	$\frac{1}{2}$	—	$\frac{1}{4}$	$\frac{1}{4}$	14
3rd ,, ...	—	—	—	—	—	13	$\frac{1}{4}$	—	$\frac{1}{4}$	$\frac{1}{4}$	14
4th ,, ...	—	—	—	—	—	13	$\frac{1}{4}$	—	$\frac{1}{4}$	$\frac{1}{4}$	14
(Four coats and flatting.)											
1st coat, or priming........	—	—	—	—	$1\frac{1}{2}$	16	$\frac{3}{4}$	—	$\frac{1}{16}$	$\frac{1}{8}$	16
2nd ,, ...	—	—	—	—	—	12	$\frac{1}{2}$	—	$\frac{1}{4}$	$\frac{1}{10}$	14
3rd ,, ...	—	—	—	—	—	12	$\frac{1}{2}$	—	—	$\frac{1}{10}$	14
4th ,, ...	—	—	—	—	—	12	$\frac{1}{2}$	—	—	$\frac{1}{10}$	14
Flatting........	—	—	—	—	—	9	—	—	$\frac{1}{2}$	$\frac{1}{10}$	14
OUTSIDE WORK.											
(Four coats, not flatted.)											
1st coat, or priming........	—	—	—	—	2	$18\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	—	$\frac{1}{8}$	16
2nd ,, ...	—	—	—	—	—	15	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{16}$	$\frac{1}{10}$	14
3rd ,, ...	—	—	—	—	—	15	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{16}$	$\frac{1}{10}$	14
4th ,, ...	—	—	—	—	—	15	$\frac{1}{2}$	$\frac{1}{4}$	—	$\frac{1}{10}$	14

Duresco.

The following table will be found useful when ordering duresco. Plaster with great porosity would require more than the figures given. It should be borne in mind in pricing rough-cast or harled work that it measures more than double, and is very porous.

Measurement Table.

The figures show body colour only, and to this must be added $\frac{1}{2}$ cwt. petrifying liquid to each cwt. body.

Duresco.	14 lb.	28 lb.	56 lb.	112 lb.
1 coat	112 yards	225 yards	450 yards	900 yards
2 coats	56 ,,	112 ,,	225 ,,	450 ,,
3 coats	37 ,,	75 ,,	150 ,,	300 ,,

This table has now been in daily use for over eight years, the orders of customers having been calculated by it with the most satisfactory results during all that time.

Black paint—	$12\frac{3}{4}$ lb. black	will cover 100 yards super.
	$\frac{3}{4}$ lb. driers	
	$2\frac{3}{4}$ pints raw oil	
	$2\frac{3}{4}$ pints boiled oil	

Oxide of Iron Paint.

Oxide of iron paints, weight for weight, usually cover a surface of $1\frac{1}{2}$ to $1\frac{3}{4}$ that of white-lead paint, and require for thinning about $6\frac{1}{2}$ gal. linseed-oil ($\frac{1}{3}$ boiled and $\frac{2}{3}$ raw) and 2 gal. turpentine per cwt. of the oxide ground in oil.

1 lb. ready-mixed Wolston's Torbay paint covers	10 yd.	super.	1st coat.
,, ,, ,, ,, ,, ,,	15	,,	2nd ,,
,, ,, ,, ,, ,, ,,	20	,,	3rd ,,
,, red-lead paint covers on iron	5	,,	1st ,,
1 gal. Wolston's enamel paint covers	60	,,	

1 cwt. dry Carson's anti-corrosion paint requires 8 to 10 gal. oil mixture, and covers 400 to 500 yards super. on woodwork, 1 coat.

1 cwt. dry Carson's anti-corrosion paint requires 8 to 10 gal. oil mixture, and covers 600 to 700 yards super. on ironwork, 1 coat.

1 gal. tar, with 1 lb. pitch, will cover 12 yards super., 1st coat on wood.

,, ,, ,, ,, ,, 17 ,, each additional coat on wood.

1 pint varnish covers 8 to 9 yards super., single coat.

1 gal. liquid stain will cover 100 yards super.

Gold-leaf is classed as singles, doubles, or trebles. A book of gold-leaf contains 25 leaves, $3\frac{1}{4}$ in. by $3\frac{1}{4}$ in., or 1 ft. $7\frac{1}{2}$ in. super., and will cover about a foot super. of plain work. It is calculated by the 1,000 leaves.

Constants of Labour.

		Hours.	
Knotting...	per yd. sup.	·5	painter.
Stopping...	,,	·5	,,
1st or priming coat on wood	,,	·16	,,
2nd and following coats, each	,,	·14	,,
1st coat on iron...	,,	·25	,,
2nd and following coats, each	,,	·22	,,
Add if done from a ladder	,,	·10	,,
Iron bars, fillets, &c., 1 coat	per yd. run	·06	,,
Sash squares, each side, 1st coat	per doz.	·50	,,
,, ,, ,, 2nd coat	,,	·40	,,
Tarring, 1st coat on wood	per yd. sup.	·25	labourer.
,, 2nd and following coats	,,	·20	,,
,, 1st coat on iron	,,	·28	,,
,, 2nd ,, ...	,,	·21	,,

PRICES,

Including all preparatory work, such as scraping, stopping, knotting, cleaning, rubbing down, &c.

Common Colours.

Description.	One Coat.		Two Coats.		Three Coats.		Four Coats.		Flatting.	
Superficial Work.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Plain painting ....per yd. sup.	0	$3\frac{3}{4}$	0	6	0	8	0	10	0	2
Carved work .... ,,	0	$9\frac{1}{2}$	1	3	1	8	2	0	0	4
Plain cornices, entablatures, fascias, pilasters, &c...per yd. sup.	0	4	0	7	0	9	0	11	0	3
Enriched cornices......... ,,	0	9	1	2	1	7	2	0	0	6
Block or cantilever cornices ,,	0	$5\frac{1}{2}$	0	9	1	1	1	5	0	4
Gates, railings, fencing gratings, &c., with stays ....per yd. sup.	0	$4\frac{1}{2}$	0	7	0	10	1	1	—	
Skylights to out-and-out of frame ....per yd. sup.	0	$4\frac{1}{2}$	0	7	0	10	1	1	—	
(For external work done off ladders add 10 to 15 per cent.)										
Lineal Work.										
Gutters, inside and out, with brackets ....per yd. run	0	3	0	5	0	7	0	9	—	
Add for cleaning out ditto and stanching joints with white or red lead ....per yd. run	0	1	—		—		—		—	
Rain-water, soil, and vent pipes and shoes ....per yd. run	0	3	0	$4\frac{1}{2}$	0	6	0	$7\frac{1}{2}$	—	
Bars, pipes under 2 in. diam., beads, fillets, cutting in lines, shelf-edges, stays, &c., per yd. run	0	1	0	$1\frac{1}{2}$	0	2	0	$2\frac{1}{2}$	—	
Angle staves, chair-rails and bands, frames, fillets, &c., under 4 in. girth, hand rails, reveals, tee and angle iron, skirting, mouldings, &c., under 9 in. girth ......per yd. run	0	$1\frac{1}{2}$	0	2	0	$2\frac{1}{2}$	0	3	0	1

COMMON COLOURS—*continued.*

Description.	One Coat.		Two Coats.		Three Coats.		Four Coats.		Flatting.	
LINEAL WORK—*continued.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Skirtings and mouldings, 9 in. to 14 in. girth............per yd. run	0	2	0	2½	0	3	0	4	0	1¼
NUMERAL WORK.										
Ashbins, outside .... each	1	8	2	6	3	4	4	2	—	
Balusters, or small newels ...... ,,	0	1	0	1½	0	2	0	2½	0	0¾
Bails, including chains .... ,,	0	4	0	6	0	9	1	0	—	
Bell boards, 3 ft. by 9 in. ...... ,,	0	1½	0	2½	0	3½	0	4½	—	
Brackets or cantilevers, small ,,	0	1	0	2	0	3	0	4	0	0½
,, ,, large ,,	0	6	0	9	1	0	1	3	0	3
Casement lights, one side ...... ,,	0	4	0	6	0	8	0	10	0	2
Casement frames .... ,,	0	4½	0	6½	0	8½	0	10½	0	2
Chimneypieces, plain .... ,,	0	7	0	11	1	3	1	7	0	5
,, ornamental ... ,,	0	9	1	2	1	8	2	1	0	7
Cisterns, feed........................ ,,	0	3	0	5	0	7	0	9	—	
Casement fasteners............per doz.	0	3½	0	5½	0	8	0	10	—	
Door scrapers........................ each	0	1½	0	2	0	3	0	4	—	
Fanlights, including frames, one side .... ,,	0	5	0	8	0	11	1	2	0	3
Finger-plates, 14 in. by 4 in., per doz.	1	0	1	6	2	0	2	6	0	6½
Hay-racks and manger combined .... each	1	2	1	9	2	4	3	0	—	
Hopper heads........................ ,,	0	3	0	4	0	5	0	6	—	
Heads and shoes, iron, for roof trusses.............................. ,,	0	2	0	3	0	4	0	5	—	
Hinges, swing-bars, &c. .... ,,	0	3	0	4	0	5½	0	7	—	
Hooks, pins, staples, knobs, buttons, bolts, nuts, small hinges, latches, handles, &c. ......per doz.	0	6	0	9	1	0	1	3	—	
Heads of nuts .... ,,	0	2½	0	3½	0	5	0	6½	—	
Lamps, and lamp-irons .... each	0	3	0	5	0	7	0	9	—	
Lamp-posts and columns, drying posts.............................. ,,	0	7	0	11	1	3	1	7	—	
Locks, including staples......per doz.	0	10	1	3	1	8	2	2	0	5
Pumps, including handles ...... each	0	8	1	0	1	5	1	10	—	
Rafter feet.........................per doz.	0	7	0	11	1	3	1	7	—	
Sash or door frames, one side, under 10 ft. super. .... each	0	3	0	5	0	7	0	9	0	2½
Ditto, ditto, 10 ft. to 25 ft. super. ,,	0	4½	0	7	0	9½	1	0	0	4½
Ditto, ditto, over 25 ft. super. ,,	0	5½	0	8½	1	0	1	4	0	5½
Sash squares, under 1 ft. sup., per doz.	0	4½	0	8	0	10½	1	2	0	3
,, 1 ft. to 3 ft. super. ,,	0	6	0	10	1	2	1	6	0	5
Shutter or other bars .... each	0	1	0	1½	0	2¼	0	3	—	
Ventilators, including frames... ,,	0	2	0	3	0	4¼	0	5½	0	1

[r] Deduct 5 % from foregoing for patent zinc paints, oxide of iron paints, anti-corrosion paints, and granitic paints.

Oxide of Iron Paints.

		s.	d.
Plain painting, 1 coat	per yd. sup.	0	3¼
,, 2 coats	,,	0	5¼
,, 3 coats	,,	0	6¾

Miscellaneous.

		s.	d.
Burning off	,,	1	0
Oiling and preparing for the first coat	,,	0	3
Pumicing and preparing old work	,,	0	3
Cleaning paintwork when ordered separately from painting by washing with soap (including soap)	,,	0	1¼
Stippling surfaces	,,	0	1½
Sanding, including the sanding coat	,,	0	5
Writing plain letters or figures, one or two coats	per inch in height	0	1
,, shaded ,, ,, ,,	,,	0	1½

Superior Colours.

Description.		One Coat.		Two Coats.		Flatting.	
		s.	d.	s.	d.	s.	d.
Superior colours, such as olive greens, cobalt blues, &c.	per yd. sup.	0	6½	0	9½	0	4
Plain cornices and mouldings, columns, pilasters, &c.	,,	0	8	0	11	0	7
Enriched cornices or other carved work	,,	1	0	1	6	0	10
Moulded skirting.......................	,,	0	7	0	10	0	6
Chair rail, rail and pin, angle staff, &c.	per ft. run	0	1	0	1½	0	1
Shelf edge	,,	0	0½	0	0¾	0	0½
Balusters, or small newels............	each	0	1½	0	2½	0	1½
Chimneypieces..........................	,,	0	9	1	2	0	9
Consoles	,,	0	9	1	2	0	9
Pilaster caps.............................	,,	0	7	0	9	0	7
Sash frames, one side, 10 to 25 ft. sup.	,,	0	7	0	10	0	7
,, squares, ,, 1 to 3 ft. sup.	per doz.	0	8	0	11	0	8

Varnishing, Graining, &c.

Description.	Copal Varnish.				Graining.						Stain.		Size.	
	One Coat.		Two Coats.		Oak.		Maple.		Clean and Touch up.		One Coat.		One Coat.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Superficial work, per yd. sup.	0	7	1	0	1	3	2	0	0	4	0	2½	0	1
Skirting, surbase, chair-rail ....per ft. sup.	0	1½	0	2½	0	3¼	0	5	0	1	0	0½	0	0¼
Handrails ......per ft. run	0	1½	0	2½	0	2½	0	4½	0	0½	0	0½	0	0¼

Varnishing, Graining, &c.—*continued.*

Description.	Copal Varnish. One Coat.	Copal Varnish. Two Coats.	Graining. Oak.	Graining. Maple.	Graining. Clean and Touch up.	Stain. One Coat.	Size. One Coat.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Shelf edge ...... per ft. run	0 0½	0 0¾	0 2	0 4	0 0½	0 0¼	0 0¼
Skirting, narrow ,,	0 1	0 2	0 2¼	0 4¼	0 0½	0 0½	0 0¼
Balusters .... each	0 2	0 3½	0 4	0 6	0 1½	0 0½	0 0¼
Fanlights and frames, one side............ ,,	0 10	1 6	2 0	2 6	0 4	0 6	0 3
Sash-frames, one side ,,	0 7	1 0	2 0	2 10	0 4½	0 4½	0 2
Sash transoms, one side ,,	0 3½	0 6	0 10	1 6	0 2	0 2	0 0¾
Door-frames, including architraves, o. s..... ,,	1 10	2 8	2 6	4 0	0 6	0 11	0 2½
Sash-squares, 1 to 3 ft. super, o. s. ......per doz.	0 8	1 3	2 0	3 0	0 4	0 4	0 1½

French-Polishing, &c.

		s.	*d.*
French-polishing, superficial work	per ft. sup.	0	7
,, ,, oak or mahogany hand-rails ...	per ft. run	0	5
Cleaning, preparing, and repolishing old ditto ...	,,	0	3
,, ,, ,, ,, woodwork...	per ft. sup.	0	4
Wax polishing	,,	0	6

Gilding.

Gilding in best oil gold, plain	,,	4	0
,, ,, burnished	,,	5	6

Tarring.

Description.		One Coat.	Two Coats.
		s. *d.*	*s.* *d.*
Tarring with Stockholm tar, mixed with 1 lb. pitch to 1 gal. tar	per yd. sup.	0 3	0 5¼
Ditto with coal-tar, mixed with 1 lb. pitch and 1 lb. resin to 6 gal. tar......	,,	0 2	0 3½
Ditto water or gas pipes.....................	per ft. run	0 0½	0 0¾
Tarring on new felt roofing with purified coal-tar and spent lime, or pounded chalk, and sanding	per square	1 8	2 6
Ditto after one year's wear	,,	2 3	3 0
,, two years' ,, ...	,,	3 0	4 0

Materials
(supplied only).

		s.	*d.*
Alum	per lb.	0	1½
Atkinson's composition for removing and cleaning paint	,,	1	0
Beeswax	,,	1	8

MATERIALS (SUPPLIED ONLY)—*continued.*

		s.	d.
Bricks, Bath	each	0	2
Copperas, green	per cwt.	5	0
,, white	,,	14	0
Driers, patent, for white-lead paints	per lb.	0	3
,, ,, Torbay paste	,,	0	3½
,, ,, for zinc paints	,,	0	5
,, ,, liquid, Terebene...	per gal.	10	0
Dragon's blood, powdered	per lb.	2	6
Flannel, best quality, for cleaning	per yard	0	8
French polish, best	per gal.	12	6
Glue, good, bright, for size only	per lb.	0	3½
Glasspaper, sand, or emery	per quire	0	10
Gold-leaf, double	per book	2	0
Gold size	per gal.	10	0
Knotting, patent	,,	9	6
Lead, red, dry	per lb.	0	3
,, ,, ground in oil	,,	0	3½
,, white, dry	,,	0	3
,, ,, ground in oil	,,	0	3½
,, sugar of	,,	0	4
Linseed oil, raw	per gal.	2	6
,, ,, boiled	,,	2	9
Litharge	per lb.	0	4
Mordant to make paint adhere to zinc surfaces (composed of soft water 64 parts, chloride of copper 1 part, nitrate of copper 1 part, sal ammoniac 1 part, and hydrochloric acid 1 part)...	per gal.	3	6
Mordant, Calley and Wolston's (1 gal. mixed with 5 gals. water)	,,	10	0
Naphtha, spirit	,,	3	6
Olive oil, Spanish	,,	3	0
Paint, dry, anti-corrosion	per lb.	0	3
,, ,, blue-black	,,	0	1
,, ,, ivory black	,,	0	1½
,, ,, Venetian red	,,	0	2
,, ,, lampblack	,,	0	2
,, ,, green copperas	,,	0	1
,, ,, ochre	,,	0	1¼
,, ,, Prussian blue...	,,	3	0
,, ,, ultramarine blue	,,	1	0
,, ,, vandyke brown	,,	0	7½
,, ,, Spanish brown	,,	0	2½
,, ,, raw umber	,,	0	1¼
,, ,, raw sienna	,,	0	6
,, ,, burnt sienna	,,	0	9
,, ,, Brunswick green	,,	0	2½
,, ,, oxide of zinc	,,	0	4
,, ,, silicate oxide of iron	,,	0	3
,, ground in oil, emerald green	,,	0	10
,, ,, sulphide of zinc	,,	0	4
,, ,, vermilion	,,	6	0
,, Calley and Wolston's Torbay oxide of iron (browns and reds), mixed in paste for use ...	,,	0	4
Ditto, ditto, ditto, ditto	per cwt.	32	0

Materials (supplied only)—*continued.*

		s.	d.
Paint, Calley and Wolston's Torbay oxide of iron (browns and reds), liquid mixed for use	per gal.	5	0
Ditto, ditto, ditto, drying oil thinnings	,,	3	6
Pitch, common	per lb.	0	1
,, Stockholm	,,	0	1¼
Potash	,,	0	6
Pumice stone	,,	0	5
Putty, oil	,,	0	1½
,, white or red lead	,,	0	3
Size, best quality	,,	0	3
Soda	,,	6	0
Soft soap	,,	0	3
Sulphate of copper	,,	0	4
Stains, oak	per gal.	7	0
Szerelmey stone liquid, in 5-gal. drums	,,	7	0
,, iron paints, common colours, ready for use	,,	5	6
,, ,, oil for thinning ditto	,,	3	0
Tar, coal	,,	0	4
,, Stockholm, in 30 gal. barrels	,,	0	10½
Turpentine, spirits of	,,	3	0
Varnish, Brunswick black	,,	6	6
,, copal, pale	,,	16	0
,, Japan black	,,	12	0
,, naphtha	,,	6	0
,, oak, No. 2	,,	9	0
,, staining	,,	12	0
,, hard spirit	,,	6	6
,, Berlin black	,,	8	0
Whiting, best washed, in lumps	per lb.	0	0¼
Wine, spirits of	per pint	3	6
,, methylated	,,	1	0
Wages, painter's	per hour	0	9
,, grainer's or writer's	,,	1	0
,, gilder's	,,	1	0

ANALYSIS.

Materials.

The materials required for painting are *bases* (white-lead, red-lead, zinc-white, oxide of iron), *vehicles* (water, oils, spirits of turpentine), *solvents* (spirits of turpentine), *driers* (litharge, acetate of lead, sulphate of zinc, binoxide of manganese, red-lead, &c.), *colouring pigments* (ochres, lampblack, umber, sienna, &c.).

Bases.—White-lead is a carbonate of the metal. It is sold either dry in powder, or else ground in linseed-oil, and should be genuine. It is frequently adulterated with sulphate of baryta, sulphate of lead, whiting, chalk, &c. Old white-lead of good quality goes further and lasts better than if it is used when fresh.

Red-lead is an oxide of lead, and is usually in the form of a bright red powder. It is sometimes adulterated with brick-dust. Zinc-white is an oxide of zinc, and is the basis of zinc paint. It is wanting in density, does not combine so well with oil, is difficult to work, and is lacking in body and covering power. Special driers are also required. It is now being superseded by Griffith's white, or oxysulphide of zinc.

Oxide of iron is produced from a brown hæmatite ore found at Torbay in Devonshire. These paints are supposed to have more affinity for iron than lead paints, and are cheaper, as, weight for weight, they go further.

Vehicles.—Linseed-oil is a fixed or fatty oil, obtained by crushing the seeds of the flax-plant, and does not evaporate on drying. It oxidises and becomes thick on exposure to the air. Raw linseed-oil improves in colour and drying properties by keeping for several years. The best comes from the Black Sea and the Baltic. Boiled linseed-oil, or "drying oil," is prepared by heating raw oil with certain driers, or by passing a current of air through raw oil. It is thicker and darker in colour, and is used for outside work.

Solvents.—Spirits or oil of turpentine, commonly called "Turps," is an essential or volatile oil, produced by distilling turpentine tapped from pines or larches. The best comes from America. It is useful in flatting coats, as it takes away the glare of the linseed-oil, but will not stand exposure to the weather. Benzine is sometimes employed as an adulterant.

Driers.—As the drying of linseed-oil is due to the readiness with which it absorbs oxygen, the process is quickened by adding substances called driers, which, in giving up the oxygen which they contain, assist the oxidation of the oil. As also many pigments retard the drying of the oil, the addition of driers is necessary to prevent the paint from remaining sticky or "tacky." Litharge, or oxide of lead, is the most common drier. Massicot is a superior kind of litharge, often used. Acetate of lead, or sugar of lead, ground in oil; sulphate of zinc (improperly called white copperas and white vitriol), especially for light tints; binoxide of manganese, for dark colours and quick drying; red lead, not so quick as litharge; and other substances, are all used. Patent driers contain certain of the foregoing, ground and mixed in oil, and therefore in a convenient form for use. Terebene is a powerful drier dissolved in turpentine. Resin is sometimes mixed with paint to make it dry.

Colouring Pigments.—It is impossible to give even a bare list of these, as they are made from so many substances, including vegetables and minerals.

Tar.—Coal-tar is a by-product in the manufacture of gas. When itself distilled it produces in various stages coal naphtha, creosote, and pitch (not to be confounded with mineral pitch or bitumen). Coal-tar is cheaper than wood tar. Wood tar is produced from the resinous products of firs and pines. It is imported in barrels containing about thirty gallons, chiefly from Stockholm and Archangel. Being thinner than coal-tar, it enters the pores of the wood more freely, and so preserves it better. The residue after distillation is also pitch.

Pitch is added to both coal and wood tar, in the proportion of 1 lb. pitch to 1 gal. tar, in order to fix it, and prevent its running in hot weather. A little lime is added for the same purpose. Another mixture is 1 lb. pitch and 1 lb. resin to 6 gal. of coal-tar.

Knotting prevents the exudation of turpentine from knots, or knots from absorbing the paint, thus leaving marks on the painted surface. Hot lime can be used to kill knots; but, as it takes time, patent knotting, chiefly shellac dissolved in naphtha, is more frequently employed, as it dries in five minutes. Red-lead, ground in water, and mixed with strong glue size, and used hot, is often considered preferable to patent knotting, and dries in ten minutes.

Painter's Putty is composed of whiting (powdered chalk), mixed with raw linseed oil to a stiff paste, and well kneaded.

Varnish is a solution of resin in either oil, turpentine, or alcohol. The oil driers and the other two solvents evaporate, leaving a solid transparent film of resin over the surface varnished. Copal varnish is the best, and is prepared from gum copal dissolved under heat with the best linseed-oil. No other varnish should be used for outside work. Common varnish is made by dissolving 2 lb. resin, under a gentle heat, in 1 gal. linseed-oil, and then adding gradually 1 quart turpentine. Cheap oak varnish is used for common work, and is made by dissolving $3\frac{1}{2}$ lb. resin in 1 gal. turpentine.

French polish is made by dissolving $1\frac{1}{2}$ lb. shellac in 1 gal. spirits of wine, without heat.

Common Colours.

Knotting.—This is the first operation. If red-lead knotting is used, then $\frac{1}{3}$ lb. of red-lead and $\frac{1}{3}$ lb. glue, mixed with

water and applied hot, equal $\frac{2}{3}$ lb. paste, will cover 100 yards super. Labour, 5 hours painter.

	s.	d.
$\frac{1}{3}$ lb. red-lead, dry, at 3*d*.	0	1
$\frac{1}{3}$ lb. glue at $3\frac{1}{2}$*d*.	0	$1\frac{1}{4}$
5 hours painter at 9*d*.	3	9
	3	$11\frac{1}{4}$
Add 15 per cent. profit	0	7
	100)4	$6\frac{1}{4}$
Price per yard super.	0	$0\frac{1}{2}$

Stopping.—Priming or first coat is really the next operation, stopping being done on the top of this, as the putty would not otherwise stick; but for the sake of convenience the latter is analysed first; 4 lb. putty, $\frac{1}{2}$ lb. pumice stone, and 1 quire glasspaper will be required for 100 yards super. Labour as last item.

	s.	d.
4 lb. oil-putty at $1\frac{1}{2}$*d*.	0	6
$\frac{1}{2}$ lb. pumice stone at 5*d*.	0	$2\frac{1}{2}$
1 quire glasspaper at 10*d*.	0	10
5 hours painter at 9*d*.	3	9
	5	$3\frac{1}{2}$
Add 15 per cent. profit	0	10
	100)6	$1\frac{1}{2}$
Price per yard super.	0	$0\frac{3}{4}$

Plain Painting, 1 *Coat.*—This is the priming coat, and to obtain its complete value, including preparatory work, the cost of knotting and stopping, &c., must be added; $\frac{1}{2}$ lb. red-lead, 16 lb. white-lead, $\frac{3}{4}$ gallon raw linseed-oil, and $\frac{1}{4}$ lb. driers (litharge) will cover 100 yards inside work. See table in "Memoranda." Labour, 16 hours painter.

	s.	d.
$\frac{1}{2}$ lb. red-lead, dry, at 3*d*.	0	$1\frac{1}{2}$
16 lb. white-lead, dry, at 3*d*.	4	0
$\frac{3}{4}$ gal. raw linseed-oil at 2*s*. 6*d*.	1	$10\frac{1}{2}$
$\frac{1}{4}$ lb. litharge at 4*d*.	0	1
16 hours painter at 9*d*.	12	0
	18	1
Add 15 per cent. profit	2	8
	100)20	9
	0	$2\frac{1}{2}$
Add cost of knotting	0	$0\frac{1}{2}$
,, stopping	0	$0\frac{3}{4}$
Total price per yard super.	0	$3\frac{3}{4}$

Ditto, 2 *Coats*.—The second coat requires 15 lb. white-lead, ½ gal. raw linseed-oil, ¼ gal. turpentine, and ¼ lb. driers (litharge) per 100 yards inside work. Labour, 14 hours painter. To price of this add value of first coat.

	s.	d.
15 lb. white-lead, dry, at 3*d*.	3	9
½ gal. raw linseed-oil at 2*s*. 6*d*.	1	3
¼ gal. turpentine at 3*s*.	0	9
¼ lb. litharge at 4*d*.	0	1
14 hours painter at 9*d*.	10	6
	16	4
Add 15 per cent. profit	2	5
	100)18	9
	0	2¼
Add first coat	0	3¾
Total price per yard super.	0	6

Ditto, 3 *Coats*.—The third coat requires 13 lb. white-lead, ¼ gal. raw linseed-oil, ¼ gal. turpentine, and ¼ lb. driers per 100 yards, inside work. Labour, 14 hours painter. To price of this add value of first and second coats.

	s.	d.
13 lb. white-lead, dry, at 3*d*.	3	3
¼ gal. raw linseed-oil at 2*s*. 6*d*.	0	7½
¼ gal. turpentine at 3*s*.	0	9
¼ lb. litharge at 4*d*.	0	1
14 hours painter at 9*d*.	10	6
	15	2½
Add 15 per cent. profit	2	3½
	100)17	6
	0	2
Add first and second coats	0	6
Total price per yard super.	0	8

Ditto, 4 *Coats*.—From the table in "Memoranda" it will be seen that the fourth coat requires the same materials and labour as the last coat, and therefore the price will be also the same—viz., 2*d*. per yard.

	s.	d.
Cost of first, second, and third coats	0	8
,, fourth coat	0	2
Total price per yard super.	0	10

Flatting.—This requires 9 lb. white-lead, $\frac{1}{2}$ gal. turpentine and $\frac{1}{10}$ lb. driers, per 100 yards. Labour, 14 hours painter.

	s.	d.
9 lb. white-lead at 3*d.*	2	3
$\frac{1}{2}$ gal. turpentine at 3*s.*	1	6
$\frac{1}{10}$ lb. litharge at 4*d.*	0	0½
14 hours painter at 9*d.*	10	6
	14	3½
Add 15 per cent. profit	2	1½
	100)16	5
Price per yard super.	0	2

The cost of outside work can be ascertained in the same way from the table of materials and labour given in "Memoranda." For external work done off ladders, add 10 to 15 per cent.

For the small surfaces in lineal and numeral work, such as skirtings, pipes, &c., find what fraction the superficial area of these is to one square yard, and then price proportionately, adding a suitable percentage for work in small quantities; thus :—

4-*in. Cast-iron Pipes*, 2 *Coats.*—The circumference of this would be 1 ft. × 1 yard run = 3 ft. super. = $\frac{3}{9}$ or $\frac{1}{3}$ yard super.

	s.	d.
$\frac{1}{3}$ yard super. 2 coats at 6*d.*	0	2
Add for work in small quantities, say	0	2½
Price per yard run...	0	4½

Proceed similarly for such items as sash and door frames, sash squares, &c., in which there will be extra labour. These, however, can be jumped at without exact calculations.

Oxide of Iron Paint.

For this a reduction of 5 per cent. in cost from common colours is reckoned as a safe guide in pricing. For cash with order, or monthly account, the discount is 20 per cent. for 20 cwt. and upwards, 15 per cent. for 5 to 20 cwt., and 10 per cent. for smaller quantities.

Plain Painting, 1 *Coat.*—1 lb. of paint, ready mixed, will cover on iron 10 yards super., 1 coat. Labour, 2½ hours painter.

OXIDE OF IRON PAINT—*continued.*

	s.	d.
1 lb. paint, ready mixed, at 4*d.*	0	4
$\frac{1}{21}$ gal. thinnings at 3*s.* 6*d.*	0	2
$2\frac{1}{2}$ hours painter at 9*d.*	1	$10\frac{1}{2}$
	2	$4\frac{1}{2}$
Add 15 per cent. profit	0	$4\frac{1}{2}$
	10)2	9
Price per yard super.	0	$3\frac{1}{4}$

Ditto, 2 *Coats.*—1 lb. of paint will here cover 15 yards super. for the second coat. Labour, $2\frac{1}{4}$ hours painter.

	s.	d.
1 lb. paint, ready mixed, at 4*d.*	0	4
$\frac{1}{21}$ gal. thinnings at 3*s.* 6*d.*	0	2
$2\frac{1}{4}$ hours painter at 9*d.*	1	8
	2	2
Add 15 per cent. profit	0	4
	15)2	6
	0	2
Add first coat	0	$3\frac{1}{4}$
Total price per yard super.	0	$5\frac{1}{4}$

Ditto, 3 *Coats.*—1 lb. of paint will now cover 20 yards super. for the third coat. Labour, $2\frac{1}{4}$ hours painter.

	s.	d.
1 lb. paint, ready mixed, at 4*d.*	0	4
$\frac{1}{21}$ gal. thinnings at 3*s.* 6*d.*	0	2
$2\frac{1}{4}$ hours at 9*d.*	1	8
	2	2
Add 15 per cent. profit	0	4
	20)2	6
	0	$1\frac{1}{2}$
Add first and second coats	0	$5\frac{1}{4}$
Total price per yard super.	0	$6\frac{3}{4}$

VARNISHING.

Copal Varnish, 1 *Coat.*—Copal varnish is the best, and should alone be used for outside work. It varies very much in price. A pint, or $\frac{1}{8}$ gal., will cover 14 yards, 1 coat.

VARNISHING—*continued.*

	s.	d.
$\frac{1}{8}$ gal. copal varnish at 16*s*.	2	0
3 hours painter at 9*d*.	2	3
	4	3
Add 15 per cent. profit	0	$7\frac{1}{2}$
	8)4	$10\frac{1}{2}$
Price per yard super.	0	7

TARRING.

Tarring, 1 *Coat*.—1 gal. tar, mixed with 1 lb. pitch and applied hot, will cover 12 yards super., first coat on wood. Labour, 3 hours of labourer.

	s.	d.
1 gal. Stockholm tar	0	$10\frac{1}{2}$
1 lb. Stockholm pitch	0	$1\frac{1}{4}$
3 hours labourer at $6\frac{1}{2}d$.	1	$7\frac{1}{2}$
	2	$7\frac{1}{4}$
Add 15 per cent. profit	0	$4\frac{3}{4}$
	12)3	0
Price per yard super.	0	3

Ditto, 2 *Coats*.—The same materials will cover 17 yards for the second coat. Labour $3\frac{1}{2}$ hours.

	s.	d.
1 gal. Stockholm tar...	0	$10\frac{1}{2}$
1 lb. Stockholm pitch	0	$1\frac{1}{4}$
$3\frac{1}{2}$ hours labourer at $6\frac{1}{2}d$.	1	$10\frac{3}{4}$
	2	$10\frac{1}{2}$
Add 15 per cent. profit	0	5
	17)3	$3\frac{1}{2}$
	0	$2\frac{1}{4}$
Add first coat	0	3
Total price per yard super.	0	$5\frac{1}{4}$

CHAPTER XVIII.—GLAZIER.

MEMORANDA.

Crown Glass.

A crate contains		12 tables of the best.		
,,	,,	15	,,	seconds.
,,	,,	18	,,	thirds.
,,	,,	18	,,	fourths.

The tables measure either 48 in. or 54 in. diameter. The former yields about $8\frac{1}{2}$ ft. super. of glass fit for glazing, and the latter about $11\frac{1}{2}$ ft. super. For every $\frac{1}{16}$ in. thick it weighs 13 oz. per foot super. Crown glass is going out of use.

Sheet glass may be obtained in four qualities—best, 2nds, 3rds, and 4ths, weighing 15 to 42 oz. per foot super.

Limits of Size in Sheet Glass.

The extreme limits of length and width cannot be combined in the same sheet.

Weight.	Thickness.	Extreme Length.	Extreme Width.	Extreme Area.
15 oz.	$\frac{1}{12}$ in.	60 in.	40 in.	15 ft.
21 ,,	$\frac{1}{10}$,,	90 ,,	50 ,,	26 ,,
26 ,,	$\frac{1}{8}$,,	90 ,,	50 ,,	25 ,,
32 ,,	$\frac{1}{7}$,,	85 ,,	50 ,,	21 ,,
36 ,,	$\frac{1}{6}$,,	70 ,,	44 ,,	17 ,,
42 ,,	$\frac{1}{5}$,,	70 ,,	44 ,,	15 ,,

For every $\frac{1}{16}$ in. thick it weighs 13 oz. per foot super. English sheet glass is sold in crates of 200 to 400 ft. super.

15 oz.	has	40	sheets, of	stock sizes,	per crate.
21 oz.	,,	34	,,	,,	,,
26 oz.	,,	28	,,	,,	,,

Foreign sheet glass is sold in cases of 300 ft. for 15 oz. of 3rd and 4th qualities, and per cases of 200 ft. for all other weights and qualities.

Rough-rolled plate (plain and fluted) may be obtained in thicknesses of $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., and $\frac{3}{8}$ in., and up to 100 in. long, or 30 in. wide, and 30 ft. in area. For every

$\frac{1}{16}$ in. thick it weighs 16 oz. per foot super. The plain rolled means fine lines on the surface.

The fluted glass is in two patterns. The small pattern has eleven flutes per inch, and the large down to four flutes per inch.

Rough Cast Plate.—Used for roofs, skylights, &c., and may be obtained up to 60 ft. in area when the thickness does not exceed $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in., or $\frac{3}{4}$ in., and 40 ft. area when the thickness is 1 in.

British Polished Plate.—Best glazing, ordinary glazing, and silvering qualities can be obtained up to 100 ft. in area. The glazing qualities are usually $\frac{1}{8}$ in., $\frac{3}{16}$ in., $\frac{1}{4}$ in., and $\frac{3}{8}$ in. in thickness, and up to 160 in. long or 96 in. wide. Greater thicknesses and sizes can be got at special rates. For every $\frac{1}{16}$ in. thick the weight is 16 oz. per foot super.

Patent plate is sheet glass polished on both sides. It is made up to 50 in. long, or 42 in. wide, and 13 ft. in area. The thicknesses and weight are as follows :—

Number.	No. 1.	No. 2.	No. 3.	No. 4.
Thickness	$\frac{1}{16}$ in.	$\frac{1}{12}$ in.	$\frac{1}{10}$ in.	$\frac{1}{8}$ in.
Weight per ft. super.... ...	13 oz.	17 oz.	21 oz.	24 oz.

Rolled cathedral glass, in light, variable tints, weighs about 26 oz. to the foot super., and $\frac{1}{8}$ in. thick, and runs up to 80 in. long, or 28 in. wide.

Constants of Labour.

		Hours of a glazier.
Crown glass stopped in new sashes	per ft. sup.	·19
,, ,, old sashes	,,	·60
Sheet glass stopped in large squares in new sashes	,,	·15
,, ,, ,, old sashes	,,	·40
Cleaning windows, both sides	,,	·03

PRICES.

Lead Lights.

		s.	d.
New lead lights of "fret lead," glazed with $\frac{1}{8}$ in. thick sheet or patent rolled plate glass, or with cathedral glass, including fixing, complete with narrow lead	per ft. sup.	1	9
Ditto, ditto, ditto, wide lead	,,	2	0
Cementing lead lights	,,	0	2
Fixing lead lights in wood frames, and banding with copper ties	,,	0	2½
Ditto, ditto, in stonework, ditto	,,	0	3½
Casements pinned in	each	0	7
Glass bull's-eyes, 5 in. diam. and 2 in. thick, bedded in red-lead	,,	1	6

Circular and Gothic heads to be measured as square, and one-third added to the price.

Sheet Glass.

(Discounts have been taken off.)

Description.		Best.			Seconds.			Thirds.		
		15 oz.	21 oz.	26 oz.	15 oz.	21 oz.	26 oz.	15 oz.	21 oz.	26 oz.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Sheet glass under 2 ft. super. per sq.	per ft. sup.	0 6	0 6½	0 8¼	0 3¾	0 4¼	0 5¾	0 2	0 3	0 5¼
,, 2 ft. to 4 ft. ,, ,,	,,	0 6½	0 7	0 8¾	0 4½	0 5½	0 6½	0 2¾	0 3¾	0 5¾
,, 4 ft. to 8 ft. ,, ,,	,,	0 7½	0 8	0 9¾	0 5½	0 6½	0 7½	0 3¾	0 4¾	0 6¾
Add if ground-glass, any size	,,	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½
Frosting squares in imitation of ground-glass	,,	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 2	0 2
Add if stopped in new sashes	,,	0 2¼	0 2¼	0 2¼	0 2¼	0 2¼	0 2¼	0 2¼	0 2¼	0 2¼
,, ,, old sashes and hacking	,,	0 4	0 4	0 4¼	0 4	0 4	0 4¼	0 4	0 4	0 4¼
Add if bedded in chamois leather......	,,	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½
Taking out glass and stopping into other sashes	,,	0 5¾	0 6	0 6½	0 5½	0 5¾	0 6	0 4½	0 5½	0 6
Lead lights in squares under 8 in. by 6 in...	,,	0 9	0 9	0 10	0 8	0 9	0 9	0 7½	0 7½	0 8
Ditto, over 8 in. by 6 in.	,,	0 7	0 7	0 8	0 6½	0 7	0 7	0 5½	0 5½	0 6
Circular cutting and risk	per ft. run	0 1½	0 1½	0 1½	0 1½	0 1½	0 1½	0 1¼	0 1¼	0 1¼
Puttying sashes or skylights	,,	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1
Painting rebates	,,	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½
Painting putty	,,	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½	0 0½

Irregular-shaped panes to be measured as square. Fractions of inches to be paid for as whole inches.

Rough Rolled and Fluted Plate Glass.

Description.		Hartley's Rough Plate.					Eleven Flutes per inch.				Four Flutes per inch.			
		⅛ in.	¼ in.	⅜ in.	½ in.	¾ in.	⅛ in.	$\frac{3}{16}$ in.	¼ in.	⅜ in.	⅛ in.	$\frac{3}{16}$ in.	¼ in.	⅜ in.
		s. d.	s d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
In squares, under 10 ft. super.......	per ft. super.	0 3½	0 6	0 9	0 9¾	2 9	0 4½	0 5¾	0 7¼	0 9¾	0 6½	0 8	0 9½	1 0
Add if stopped in new sashes	,,	0 3	0 3	0 3	0 3½	0 3½	0 3	0 3	0 3½	0 3½	0 3	0 3	0 3½	0 3½
,, ,, old sashes.........	,,	0 5	0 5	0 5	0 5½	0 5½	0 5	0 5	0 5½	0 5½	0 5	0 5	0 5½	0 5½
Taking out glass from old sashes, and stopping into other sashes...	,,	0 6	0 6½	0 7	0 7¾	0 8½	0 6½	0 6¾	0 7¾	0 8	0 7	0 7¼	0 8	0 8½
Bending	,,	1 0	1 4	1 6	1 9	2 0	1 0	1 2	1 4	1 6	1 0	1 2	1 4	1 6
Circular cutting and risk	per ft. run.	0 1	0 1½	0 1¾	0 2	0 2	0 1¼	0 1½	0 2	0 2	0 1½	0 2	0 2½	0 2½

Polished and Patent Plate Glass.

Description.		British Polished, Best Glazing.	Patent Crystal in Squares under 50 in. long or 30 in. wide.					
			2nd Quality C.			3rd Quality C.		
		¼ in.	17 oz.	21 oz.	24 oz.	17 oz.	21 oz.	24 oz.
		s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
In squares, under 2 ft. super.	per ft. super.	1 6	2 10	2 10	2 11½	2 2	2 2	2 3
,, 2 ft. to 4 ft. ,, ...	,,	1 8	3 3	3 3	3 5	2 6	2 6	2 7
,, 4 ft. to 6 ft. ,, ...	,,	1 10	3 8	3 8	3 11	2 9	2 9	3 0
,, 6 ft. to 9 ft. ,, ...	,,	2 0	4 1	4 1	4 3½	3 2	3 2	3 4
,, 9 ft. to 12 ft. ,, ...	,,	2 1	4 4	4 4	4 6½	3 4	3 4	3 6
Add if ground one side..	,,	0 5	—	—	—	—	—	—
Add if coloured	,,	1 3	1 0	1 1	1 2	1 0	1 1	1 2
Add if stopped in new sashes..................................	,,	0 4	0 3½	0 3½	0 4	0 3½	0 3½	0 4
,, ,, old sashes	,,	0 6	0 5½	0 5½	0 6	0 5½	0 5½	0 6
Circular cutting and risk	per ft. run.	0 4	0 2½	0 2½	0 3	0 2½	0 2½	0 3

The usual charge for bending plate glass is 1*s.* to 3*s.* per foot extra, according to size and radius of curve.

Miscellaneous.

		s.	d.
Sheet cathedral glass, any tint, in squares under 4 ft. super., 15 oz. ...	per ft. sup.	0	4½
Ditto, ditto, 21 oz. ...	,,	0	5
Add if stopped in new sashes ...	,,	0	3
,, ,, old sashes ...	,,	0	5
Ornamental figured rolled glass, white, Muranese, diaper, &c., s.o. ...	,,	0	6½
Ditto, ditto, tints, ditto ...	,,	0	8
Ditto, ditto, pot metal, ditto ...	,,	0	10
Extra if cut to sizes ...	,,	0	2
Hayward's prism lights, 6-in. by 4-in. lenses, in iron frames ...	,,	7	6
Patent roof glazing, Braby's ...	,,	1	6
,, ,, Rendle's ...	,,	0	9
,, ,, Shelley's "Unique" ...	,,	1	0
½-in. bevelling to glass ...	per ft. run	0	7
¾ in. ,, ,, ...	,,	0	9½
Iron saddle bars ...	,,	0	2
Cleaning windows, both sides, under 2 ft. sup.	per doz. squares	0	10
,, ,, ,, ,, 4 ft. ,,	,,	1	6

Materials.

Diamond, glazier's, No. 3 size ...	each	18	0
Flannel, best quality for cleaning ...	per yard	0	8
Sheet glass, 3rds, 15 oz., s.o., 40*s.* per case of 300 ft. =	per ft. sup.	0	1¾
,, ,, 21 oz., ,, 40*s.* ,, 200 ft. =	,,	0	2½
,, 4ths, 15 oz., ,, 33*s.* ,, 300 ft. =	,,	0	1½
,, ,, 21 oz., ,, 33*s.* ,, 200 ft. =	,,	0	2
Linseed-oil, raw ...	per gal.	2	6
,, boiled ...	,,	2	9
Putty, oil... ...	per lb.	0	1½
,, white or red-lead ...	,,	0	3
Sprigs or nails, iron ...	,,	0	8
,, copper ...	,,	1	0
Whiting, best washed, in lumps ...	,,	0	0¼
Wages, glazier's ...	per hour	0	10

ANALYSIS.

Putty is made of whiting reduced to a fine powder, mixed with as much raw linseed-oil as is necessary to form it into a stiff paste. Hard putty may be made by substituting turps for part of the oil. For soft putty mix 10 lb. whiting and 1 lb. of white-lead with the necessary quantity of boiled linseed-oil, adding to it half a gill of the best salad oil. The salad oil prevents the white-lead from hardening, and keeps the putty in a state sufficiently soft to adhere at all times, not allowing the wet to enter by the putty getting hard and cracking off, as is often the case with ordinary hard putty.

Thermo-plastic putty contains tallow, which keeps it pliable, so that it is not loosened by the expansion and contraction of large panes of glass under changes of temperature.

Sashes must first be primed before being puttied, otherwise the wood will draw the oil out of the putty and cause it to shrink and fall out. Putty should also be covered with a coat of paint to protect it from the air, or it will shrink and get loose, as the oil dries out of it by oxidation.

Solder used for lead glazing is the plumber's fine solder, 1 lead to 1 tin.

Glazing is frequently sub-let to a glass merchant as "fetched, glazed, and delivered." This saves risk, and is the cheapest plan. The low prices in this trade are sometimes due to the substitution of glass of less weight and inferior quality to that specified. Manufacturers are constantly combining and issuing new tariffs, as the price lists are termed in the trade, till these are broken by the firms who are anxious to get orders, when a collapse ensues and a lower tariff is issued. Special quotations can be obtained for large orders.

Risk of breakage, damage, and expense of carriage are borne by the purchaser, the glass being usually sent as "carriage forward." Packing-cases, blind-frames, and flannel are also charged; but packing-cases will be allowed for if returned within one month in good condition and free of expense.

On large quantities of glass there is a trade discount of 20 to 25 per cent. For polished plate glass, in sizes up to 12 ft. super., the discount is 50 per cent., and over that 40 per cent.—*i.e.*, the larger the panes the smaller the discount.

15 *oz.* 3*rds Quality Sheet Glass, in Squares under* 2 *ft. super., and stopped in New Sashes.*—Foreign or Belgian sheet glass is the kind usually sold by the middle tradesman. It is purchased wholesale per cases of 300 ft. for 15 oz. of 3rd and 4th qualities, and per cases of 200 ft. for all other weights and qualities. English sheet glass is sold in crates of so many sheets of stock sizes (see "Memoranda"). 15 oz. 3rds quality costs 40*s*. per case of 300 ft., or 1¾*d*. per foot super. Special quotations can be obtained on application, as prices fluctuate so much.

A glazier will take ·15 hour per foot super. in stopping large squares in new sashes; but as the squares are here small, and there is cutting to size, say $\frac{1}{5}$ hour. A glazier will thus cut and stop about 5 ft. super. per hour.

	s.	d.
1 ft. super. 15 oz. 3rds quality sheet-glass	0	1¾
1 oz. putty at 1½d. per lb.	0	0⅛
¼ hour glazier cutting and stopping at 10d.	0	2
Waste in cutting, 5 per cent. of cost of glass	0	0⅛
	0	4
Add profit	0	0½
Price per foot super.	0	4½

Hartley's ⅛ in. Rough Plate Glass, and Glazing in Squares under 10 *ft. super.*—This is packed in crates for cutting up, of the sizes as manufactured. Plain rolled—*i.e.*, with fine lines on the surface—is 3½*d.* per foot super., and the labour is rather more than that for sheet glass.

	s.	d.
1 ft. super. ⅛ in. Hartley's rough plate glass	0	3½
Putty at 1½d. per lb.	0	0⅛
¼ hour glazier at 10d.	0	2½
Waste in cutting, as before	0	0⅛
	0	6¼
Add profit	0	1
Price per foot super.	0	7¼

¼*-in. British Polished Plate Glass, and Glazing in Squares* 4 *ft. to* 6 *ft. super.*—For polished plate glass, in sizes up to 12 ft. super., the discount is 50 per cent., and over that 40 per cent. The price-list quotation for best glazing quality is 1*s.* 10*d.* per foot super., in plates not above 6 ft. super.; or say 1*s.*, deducting the 50 per cent. discount for sizes under 12 ft. super. A few sprigs will be required to hold in the glass. The labour will be about the same as for previous item.

	s.	d.
1 ft. super. ¼-in. British polished plate glass	1	0
Putty at 1½d. per lb.	0	0¼
Copper sprigs at 1s. per lb.	0	0½
¼ hour glazier at 10d....	0	2½
Waste in cutting, as before	0	0½
	1	3¾
Add profit	0	2¼
Price per foot super.	1	6

The price of polished plate glass is influenced to a considerable extent, particularly in the larger squares, by the number of superficial feet each sheet contains; consequently, in measuring this glass for the purpose of estimating, &c.,

care should be taken to keep the totals of the glass separate, according to the different areas of the squares.

Cleaning Windows, both Sides, under 2 ft. super.—The labour constant for this is ·03 hour glazier per foot super., or ·06 as the squares are up to 2 ft. super. And ·06 hour per square of 2 ft. super. × 12 squares = ·72, or, say, ¾ hour per dozen squares. Add flannel and whiting.

	s.	d.
¾ hour glazier at 10*d*.	0	7½
Flannel and whiting	0	1
	0	8½
Add profit	0	1½
Price per dozen squares	0	10

Muffing Glass.—A painter or glazier can muff 7 ft. super. per hour of glass, in squares about 16 in. by 10 in., by painting one coat white paint. Other prices in the glazier's trade are easily worked out in a similar manner.

CHAPTER XIX.—PAPERHANGER.

MEMORANDA.

A PIECE of English paper should be 12 yards long by 20 in. wide, and contain 60 ft. super. or 7 square yards. The 20 in. is the net width of the pattern, and adding two margins of $\frac{1}{2}$ in. each, the total width is 21 in., or 63 ft. super. Therefore divide superficial area to be covered in feet by 60 to obtain number of pieces. A piece as sold, however, seldom exceeds 11 yards in length.

Allow 1 piece in 7 for waste. The smaller the pattern the less the waste.

A double roll of paper is about 16 yards in length, whereas a bolt of paper is a roll containing any number of yards over sixteen. A bolt of canvas = 39 yards.

A piece of French paper varies, but is mostly 9 yards long by 18 in. wide (net width of pattern), and contains 41 ft. super., or $4\frac{1}{2}$ square yards.

A piece of Japanese paper is 12 yards long by 1 yard wide.

Lining paper is usually 30 in. wide.

A dozen of border is 12 yards long, or 36 ft. run.

High-class and deep friezes are sold by the yard run.

A paperhanger will paste and hang a piece per hour. Add extra time for trimming edges.

One gallon of paste, as below, will hang five pieces of English paper, or $\frac{1}{5}$th gallon per piece.

2 lb. or 1 quart wheaten flour 1 oz. alum (for strengthening) 3 pints single size (sometimes)	mixed in 1 gal. of boiling water make 1 gal. paste.

PRICES.

		s.	d.		s.	d.
Pumicing, sizing, and preparing, only, walls ...	per doz. yds. run				0	6
Taking down old paper, and washing, stopping, and preparing old walls for new paper ...	,,				0	9
Putting up lining paper, including pumicing, rubbing smooth, and sizing	,,				0	11
Hanging only satin paper, including pumicing and sizing the walls	per doz. yds. run	1	0	to	2	6
Ditto plain paper, ditto ...	,,	0	6	,,	1	0
Ditto common or flock borders	per doz. yds. run				0	3

PRICES—*continued.*

		s.	d.
Extra for papering on ceilings...	per doz. yds. run	0	3
Sewing and putting up canvas lining, including tacks, brown paper slips, and canvas	per yd. sup.	0	10
Re-straining old canvas and ditto	,,	0	2
Guttapercha sheets and hanging	,,	0	4
Varnish paper with paper varnish, 1 coat, and sizing	,,	0	4½
,, ,, 2 coats, ,,	,,	0	8

MATERIALS.

		s.	d.		s.	d.
Alum	per lb.	0	1½		—	
Canvas, best lining	per yd. sup.	0	4½		—	
Flour for paste	per lb.	0	1½		—	
Glue, good bright, for size only	,,	0	3½		—	
Japanese wall papers...	per piece	15	0	to	25	0
Lincrusta Walton, dadoes, 16 in. to 28 in. wide	per yd. run	1	6	,,	6	0
,, ,, fillings, 18 in. to 24 in. wide	,,	1	3	,,	3	3
,, ,, friezes, 5 in. to 19 in. wide	,,	0	9	,,	3	0
,, ,, ceilings, 18 in. to 21 in. wide	,,	1	0	,,	3	6
Lining paper, weighing 440 lb. per ream...	per piece	0	4	,,	1	0
Paperhangings, machine-printed pulps ...	,,	0	6	,,	1	3
,, ,, grounds...	,,	1	0	,,	3	0
,, ,, satins ...	,,	1	6	,,	3	0
,, ,, golds ...	,,	2	6	,,	6	0
,, hand-printed damasks, grounds	,,	3	0	,,	10	0
,, ,, ,, satins...	,,	4	6	,,	18	0
,, ,, ,, mica ...	,,	6	0	,,	15	0
,, (raised flocks), for painting over	,,	11	6	,,	20	0
,, embossed leather papers ...	,,	14	0	,,	42	0
,, "Anaglypta," low relief ...	,,	12	0	,,	60	0
,, Japanese leather papers ...	,,	18	0	,,	60	0
,, printed imitation granites, marbles, &c....	,,	0	6	,,	2	6
Pitch-paper, or indiarubber paper	,,	0	9	,,	2	6
Paper borders	per doz. yds.	0	9		—	
Paste, best	per gal.	1	6		—	
Pumice-stone	per lb.	0	5		—	
Resin	,,	0	1		—	
"Salamander" asbestos decorations, fillings	per ft. sup.	0	1½	upwards		
,, ,, ,, friezes	,,	0	3	,,		
,, ,, ,, dadoes	,,	0	3	,,		
,, ,, ,, ceilings	,,	0	3	,,		
Tacks	per 1,000	0	9		—	
Tinfoil, 1¼ oz. per ft. sup., in sheets 2 ft. by 1 ft., and hanging	per ft. sup.	0	2		—	
Willesden paper, for lining walls, 2 ply, 54 in. wide	per yd. run	1	0		—	
Ditto, ditto, 1 ply, 56 in. wide	,,	0	6		—	
Wages, paperhanger's	per hour	0	9		—	

ANALYSIS.

A few remarks will indicate how the prices in this trade are arrived at, without going into much detail.

Paperhangings.—There are three kinds of wall-paper in ordinary use—viz., common-printed papers, satin paper, and flock paper. The value in each case depends on the number and nature of the colours in each pattern, increasing considerably on the introduction of gold. The first two kinds are hand-printed or machine-printed: the former is considered the better, and may be known by its finish and by the marks of the pins on the margin used to guide the position of the wood-blocks, a separate block being required for each pattern. In the machine-printed papers the patterns are engraved on metal rollers—one for each colour required, the paper being printed in continuous bands several hundred yards long.

The descriptions and prices of hand-printed and of machine-printed papers may be obtained of well-known makers like Messrs. Jeffrey & Co., Islington; Woollams & Co., Manchester Square; or of wholesale houses such as Messrs. Young and Marten, Stratford, or Nicholls and Clarke, Shoreditch.

The length and breadth of ornamental and relief decorations vary considerably: they are made from 18 to 30 in. wide, and almost any length up to 12 yds. Ceiling decorations are usually made in panels about 2 ft. by 2 ft.

The trade discount on wall-papers is generally one-third, or about 33 per cent., of the marked price, but sometimes as much as 55 per cent. Some of the firms which produce the more artistic wall-papers give no trade discount. Of late there has been a great combination of paper manufacturers, and prices have consequently gone up.

Labour.—New walls should not be papered for at least a year after a house has been finished, to let the damp in the plaster dry out. Before re-papering old walls, all the old paper should first be saturated with water and then stripped off, usually by labourers or boys. The walls should then be washed with a disinfectant, such as carbolic acid, before re-papering.

One piece of paper should be pasted and hung by a paperhanger in an hour at 9*d*. Add paste, &c. In actual practice the time taken varies according to the care required by the quality of the paper. Common papers are difficult to hang well, as they are apt to tear with their own weight when

saturated with paste. Lincrusta and thick decorations are hung with a thick mixture of glue and paste, generally about one-third glue. French papers cost a trifle more to hang than English papers. The labour in hanging dadoes is somewhat more than that for upper surfaces. Where walls have to be papered in two heights, as in the case of a room with a dado rail, the cost of hanging is increased 15 per cent.

The trimming of the edges occupies additional time. In good work papers should be trimmed at both edges and butted. For cheaper work it is customary to cut off one margin of the paper only, the margin left on being covered by the next length of paper.

Example.

Wall Paper, machine-printed grounds, and hanging.—Allow per piece, $\frac{3}{4}$ hour labour for preparatory pumicing smooth, stopping, and preparing walls, 2*s.* per piece for the paper itself, 1 hour for pasting and hanging, including trimming edges, and $\frac{1}{5}$ gallon of paste.

	s.	*d.*
$\frac{3}{4}$ hour paperhanger at 9*d.*, pumicing and stopping	0	7
1 piece wall paper, machine-printed grounds	2	0
1 hour paperhanger trimming edges, pasting, and hanging ...	0	9
$\frac{1}{5}$ gallon paste at 1*s.* 6*d.*	0	$3\frac{1}{2}$
	3	$7\frac{1}{2}$
Add 15 per cent. profit	0	$6\frac{1}{2}$
Total per piece	4	2

CHAPTER XX.—GASFITTER.

MEMORANDA.

Weight of cast-iron spigot and faucet gas pipes :—

$1\frac{1}{2}$ in.	= 0 cwt. 1 qr. 3 lb.	per	6 ft.	length.
2 in.	= 0 cwt. 1 qr. 14 lb.	,,	,,	,,
3 in.	= 0 cwt. 3 qr. 14 lb.	,,	9 ft.	,,
4 in.	= 1 cwt. 1 qr. 14 lb.	,,	,,	,,
5 in.	= 1 cwt. 3 qr. 0 lb.	,,	,,	,,

Weight of wrought-iron gas tubing :—

$\frac{1}{8}$ in.	diam.	= 28 lb.	per 100 ft. run.
$\frac{1}{4}$ in.	,,	= 41 lb.	,,
$\frac{3}{8}$ in.	,,	= 60 lb.	,,
$\frac{1}{2}$ in.	,,	= 87 lb.	,,
$\frac{3}{4}$ in.	,,	= 118 lb.	,,
1 in.	,,	= 179 lb.	,,
$1\frac{1}{4}$ in.	,,	= 252 lb.	,,
$1\frac{1}{2}$ in.	,,	= 297 lb.	,,
2 in.	,,	= 448 lb.	,,
3 in.	,,	= 925 lb.	,,

Weight of composition gas tubing :—

$\frac{1}{4}$ in.	diam.	= 11 to 13 oz.	per yard run.
$\frac{3}{8}$ in.	,,	= 18 ,, 21 oz.	,,
$\frac{1}{2}$ in.	,,	= 29 ,, 34 oz.	,,
$\frac{5}{8}$ in.	,,	= 44 ,, 52 oz.	,,
$\frac{3}{4}$ in.	,,	= 52 ,, 68 oz.	,,
$\frac{7}{8}$ in.	,,	= 64 ,, 76 oz.	,,
1 in.	,,	= 80 ,, 88 oz.	,,

Composition gas-tubing is made from a mixture of tin, lead, and antimony, in 50-yard lengths.

Weight of block-tin tubing :—

$\frac{1}{4}$ in.	diam.	= 8 oz.	per yard run.
$\frac{3}{8}$ in.	,,	= 11 oz.	,,
$\frac{1}{2}$ in.	,,	= 17 oz.	,,
$\frac{5}{8}$ in.	,,	= 23 oz.	,,
$\frac{3}{4}$ in.	,,	= 30 oz.	,,
$\frac{7}{8}$ in.	,,	= 38 oz.	,,
1 in.	,,	= 47 oz.	,,

PRICES.

C.I. Spigot and Faucet Pipes.

Description.	1½ in.		2 in.		3 in.		4 in.	
	s.	d.	s.	d.	s.	d.	s.	d.
Pipes in 6-ft. lengths, including one lead joint per length, and fixing (but not digging) per ft. run	0	7	0	9	—		—	
Ditto, in 9-ft. lengths, ditto per ft. run	—		—		0	11¼	1	5½
Add for additional lead joint... each	0	10	0	11	1	3	1	8
Extra for branches, and two joints .... ,,	2	6	3	0	4	0	5	3
Ditto tees, ditto .... ,,	2	4	2	9	3	8	5	0
Ditto bends, and one joint ... ,,	1	4	1	7	2	2	3	0
Ditto caps, collars, &c., ditto ,,	1	1	1	2	1	7	2	1
Cast-iron siphons for mains... ,,	13	7	17	6	22	3	30	0
Stand-pipes and caps for siphons, all ¾ in., and connecting with siphon .... ,,	3	6	3	6	3	6	3	6
C.I. covers and frames, and siphon traps let in .... ,,	6	6	6	6	6	6	6	6
Carter's or other approved safety gas valves, with sockets or flanges .... ,,	27	8	36	0	52	0	68	0
Cutting cast-iron main .... ,,	1	6	2	0	3	0	4	0

Stout Welded Gas-pipes, &c.

Description.	¼ in.		⅜ in.		½ in.		¾ in.		1 in.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
W.I. Pipes, 1 ft. to 12 ft. lengths, s.o. ....per ft. run	0	1¾	0	2	0	2¼	0	2¾	0	3½
Add if fixed .... ,,	0	1½	0	1½	0	1¾	0	2	0	2¼
Extra for short pieces, under 1 ft. .... each	0	2¼	0	3	0	3	0	4	0	4½
Ditto connecting pieces, long screws .... ,,	0	2¾	0	4	0	4½	0	5½	0	6½
Ditto bends, elbows, and springs ,,	0	3	0	4	0	5	0	5½	0	6
Ditto tees, equal or diminishing ,,	0	2½	0	3½	0	4	0	4½	0	5
Ditto bends made in pipes ...... ,,	0	4	0	4	0	5	0	6	0	8
Ditto crosses, equal or diminishing .... ,,	0	4	0	5	0	6	0	7½	0	9
Ditto sockets, caps, nipples, plugs, &c. .... ,,	0	1½	0	2	0	2½	0	2½	0	3
Ditto iron main cocks .... ,,	1	0	1	2½	1	6	1	10½	2	7
Brass union joints .... ,,	0	3	0	3	0	4	0	8	1	0
Add to last nine items if fixed ,,	0	2	0	2	0	2¼	0	2½	0	3
Lambert's, Carter's, or other valves, screwed .... ,,	—		—		2	9	3	0	3	10

Stout Welded Gas-pipes, &c.—*continued.*

Description.	¼ in.		⅜ in.		½ in.		¾ in.		1 in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Siphon boxes, complete, one quart ...... each	—		—		5	3	5	5	6	4
Ditto, two quarts ...... ,,	—		—		—		7	0	8	0
Add to last three items if fixed ,,	—		—		0	6	0	7	0	9
Taking down old gas-pipes and removing ......per ft.	0	0½	0	0½	0	0½	0	0¾	0	1
Taking down, cleaning, and refixing pipes...... ,,	0	2	0	2	0	2½	0	3	0	3
Cutting pipes for alterations or additions, including tapping and screwing ends ...... each	0	9	0	9	0	9	1	0	1	6
Deduct 10 per cent. if butt-welded pipes and fitting are used, instead of lap-welded.										
Unions for iron pipe and fixing ,,	0	5¼	0	6¾	0	8¾	1	1	—	
Ditto tin ditto ...... ,,	0	4	0	4½	0	5¼	0	11½	—	
Universal swivels for brass-pipe and fixing ...... ,,	—		1	0	1	3½	—		—	
Ditto iron ditto...... ,,	1	3	1	6	2	9	—		—	
Cocks, stop, brass, and fixing... ,,	0	8	0	8½	0	10	1	7	—	
Ditto, pillar, for iron pipe, ditto ,,	0	9½	1	0	1	2	1	4	1	6
Ditto, brass, ditto...... ,,	0	10	0	10½	1	1½	1	8	—	
Ceiling plates, iron sizes, and fixing ...... ,,	0	9	0	11½	1	2	1	7	2	0
Ditto, brass sizes, ditto ...... ,,	—		1	0	1	2½	1	6	1	11

Small Pipes.

Description.	⅜ in.		½ in.		⅝ in.		¾ in.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Tin pipes of best block tin, including soldered joints, hooks, &c., and fixed complete ......per ft. run	0	5¼	0	7¼	0	9¼	0	11½
Composition ditto, ditto...... ,,	0	2¾	0	3¼	0	4	0	4½
Copper pipe, with brazed joints, ditto......per ft. run	0	6	0	8½	0	10½	1	1¼
Brass ditto, ditto...... ,,	0	6	0	8½	0	10½	1	1¼
Brass union couples, and ditto ... each	0	8	0	9	0	10	1	0
,, ,, tee-pieces ... ,,	1	2½	1	5	1	8	2	0

Miscellaneous.

				s.	*d.*
Brass gas brackets,	single-jointed, ½ in. by 12 in. ...	each		1	10
,, ,,	double-jointed, ½ in. by ⅜ in. by 24 in.	,,		3	6
,, ,,	stiff, ⅜ in. by 12 in.	,,		2	6
W.I. ,,	single-jointed, ½ in. by 15 in. ...	,,		4	0
,, ,,	double-jointed, ½ in. by ⅜ in. by 24 in.	,,		6	9
,, ,,	stiff, ½ in. by 12 in.	,,		2	6

MISCELLANEOUS—*continued.*

		s.	d.
Add for fixing foregoing	each	1	0
Gas brackets taken down and removed to store	,,	0	6
Mahogany turned blocks for brackets, and fixing ...	,,	1	0
Brass pendants, stiff top, $\frac{3}{4}$ in. by $\frac{1}{2}$ in.	,,	4	6
,, ,, swing top, $\frac{3}{4}$ in. by $\frac{1}{2}$ in.	,,	5	6
,, ,, stiff, 2-light, $\frac{3}{4}$ in. by $\frac{5}{8}$ in.	,,	8	0
,, ,, ,, 3-light, $\frac{3}{4}$ in. by $\frac{5}{8}$ in.	,,	12	0
Add for fixing pendants	,,	1	6
Gas pendants taken down and removed to store	,,	0	9
$1\frac{1}{2}$-in. zinc tubes, No. 12 gauge, soldered joints, and fixed	per ft. run	0	6
2-in. ditto, ditto	,,	0	8
Zinc hoods for ditto	each	1	6

		£	s.	d.
Thomas Glover & Co.'s gas-meter for 5 lights, dry s.o.	each	2	10	0
,, ,, ,, 10 ,, ,,	,,	3	5	0
,, ,, ,, 20 ,, ,,	,,	4	7	0
,, ,, ,, 30 ,, ,,	,,	5	17	0
,, ,, ,, 40 ,, ,,	,,	7	5	0
,, ,, ,, 50 ,, ,,	,,	8	10	0
,, ,, ,, 100 ,, ,,	,,	18	10	0
Fixing only gas-meters, 2 to 10 lights	,,	0	3	0
,, ,, 20 to 60 ,, ...	,,	0	4	0
,, ,, 80 to 100 ,, ...	,,	0	7	6
Charge for stamping	,,	0	1	0
The "Stott" gas governor, $\frac{1}{2}$ in., 10 lights, s.o. ...	,,	1	19	0
,, ,, $\frac{3}{4}$ in., 15 ,, ...	,,	2	16	6
,, ,, 1 in., 35 ,, ...	,,	3	16	6
,, ,, $1\frac{1}{4}$ in., 70 ,, ...	,,	4	19	0
,, ,, $1\frac{1}{2}$ in., 90 ,, ...	,,	5	19	0
,, ,, 2 in., 150 ,, ...	,,	8	11	6

MATERIALS.

(SUPPLIED ONLY.)

		s.	d.
Burners, bat's wing, or fish-tail, common...	doz.	0	6
,, Argand, chimney holders	each	2	0
,, ,, moon holders	,,	2	6
,, the "Holborn" flat flame governor	,,	0	8
Sockets for burners, straight	,,	0	3
,, ,, elbow or knee	,,	0	$4\frac{1}{2}$
Chimney glasses up to 8 in. high	,,	0	3
,, ,, for Argand burners	,,	0	3
Moon glasses, 7 in. diam., part ground	,,	0	8
,, ,, for Argand burners	,,	2	0
Glass ceiling shades, 8 to 12 in. diam. ...	per in. in diam.	0	$1\frac{1}{4}$
Cement, iron, best quality	per lb.	0	6
Chain, brass, for pendant	,,	1	7
Flexible tubing to pattern	per ft. run	1	0
Brass couplings for ditto	each	1	6
Brass backs, with cocks and unions for ditto	,,	2	2

MATERIALS (SUPPLIED ONLY)—*continued.*

			s.	*d.*
Ceiling plates, iron sizes, $\frac{3}{4}$-in. pipe	... ...	each	1	7
,, ,, brass sizes, ,,	... ...	,,	1	6
Cocks, stop, brass, $\frac{3}{4}$ in.	... ...	,,	1	7
Unions for $\frac{3}{4}$-in. iron pipe	... ...	,,	1	1
Gauges, pressure, 3 in., $\frac{15}{10}$, in cases, best quality	...	,,	12	6
,, ,, 4 in., $\frac{20}{10}$, ,, ,,	... ...	,,	13	6
Glycerine	... ...	per lb.	1	10
Mercury...	... ...	,,	3	6
Solder, hard (2 copper, 1 zinc)	... ...	,,	0	11
Talc	... ...	,,	12	0
Tubing, brass	... ...	,,	0	11
,, composition	... ...	,,	0	2
,, copper...	... ...	,,	1	0
,, tin	... ...	,,	1	1
Wages, gasfitter's	... ...	per hour	0	$10\frac{1}{2}$
,, gasfitter's labourer	... ...	,,	0	7

ANALYSIS.

A detailed cost is hardly required in this simple trade.

The best material that can be used for gas services is welded wrought-iron barrel, or tubing, generally used in the black state, though galvanised tubing is better. The tubes are manufactured in lengths, varying from 2 ft. to 14 ft., and in short lengths from about 3 in. up to 2 ft.; for a single light the smallest bore should not be less than $\frac{3}{8}$ in. W. I. gas-pipes should withstand a test of not less than 50 lb. per square inch by hydraulic pressure. Composition pipes are unreliable and dangerous, and their only advantage is the ease with which they can be run round awkward bends or curves.

Gas-tubing should always be accessible, or be in sight, and not imbedded in plastering; and if under floors the boards above should have brass cups and screws, and small trap openings ought to be provided. Tubing is fixed with wall hooks or patent clips. All tubing should be laid to certain falls to allow the condensed water to be drained off at convenient points, and for this purpose screwed plugs are provided, especially below vertical main near meter, by a tee-piece.

The trade discount off list prices of iron gas-tubing is variable, from 50 to 65 per cent. Off list prices of pipe fittings, as sockets, elbows, tees, crosses, &c., an additional $2\frac{1}{2}$ per cent.; also a further discount for cash of $2\frac{1}{2}$ per cent. The discount off list prices of gasfittings is usually about 25 per cent.

APPENDIX.

MISCELLANEOUS MEMORANDA.

Triangles.

Area $= \frac{1}{2}$ base $\times$ perpendicular, or

Area $= \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$, where a, b, and c represent the sides, and s half their sum.

Square, Rectangle, Rhombus, or Rhomboid.

Area = base $\times$ perpendicular height.

Circle.

Circumference $=$ 3·1416 diameter, or say $\frac{22}{7}$ diameter.
Diameter $=$ 0·3183 circumference, or say $\frac{7}{22}$ circumference.
Area $=$ diameter^2 $\times$ ·7854, or say diameter^2 $\times$ $\frac{11}{14}$.

Sector of a Circle.

Area = radius of a circle $\times$ $\frac{1}{2}$ arc.

Cone.

Solidity = area of base $\times$ $\frac{1}{3}$ height.

Ellipse.

Circumference $= \frac{1}{2}$ major axis $+ \frac{1}{2}$ minor axis $\times$ 3·1416.
Area $= \frac{1}{2}$ major axis $\times$ $\frac{1}{2}$ minor axis $\times$ 3·1416.

Cylinder.

Surface = circumference $\times$ length + 2 area of base.
Solidity = diameter^2 $\times$ ·7854 $\times$ length.

Sphere.

Surface = diameter^2 $\times$ 3·1416.
Solidity = diameter^3 $\times$ ·5236.

Parabola.

Area = base $\times$ $\frac{2}{3}$ height.

Regular Polygons.

Area = half sum of sides $\times$ perpendicular drawn from centre.

Pyramid.

Solidity = Area of end × $\frac{1}{3}$ Height.

Prism.

Solidity = Area of end × Length.

Timber Measure.

A cord of wood = 128 cubic feet (8 ft. × 4 ft. × 4 ft.).
Cubic contents = $\frac{1}{4}$ girth of middle of log^2 × Length.

Long Measure.

12 inches = 1 foot.	40 perches = 1 furlong.
3 feet = 1 yard.	8 furlongs = 1 mile.
6 feet = 1 fathom.	3 miles = 1 league.
$5\frac{1}{2}$ yards = 1 rod, pole, or perch.	

Mètre = 39·37 inches. Kilomètre = 1093·62 yards.

Square Measure.

144 square inches	= 1 square foot.		
9 ,, feet	= 1	,,	yard.
$30\frac{1}{4}$,, yards	= 1	,,	perch.
40 ,, perches	= 1 rood.		
4 roods	= 1 acre.		
640 acres	= 1 square mile.		

Solid Measure.

1,728 cubic inches	= 1 cubic foot.		
27 ,, feet	= 1	,,	yard.

Contents of Casks.

9 gals. = 1 firkin.	54 gals. = 1 hogshead.
18 ,, = 1 kilderkin.	108 ,, = 1 butt.
36 ,, = 1 barrel.	216 ,, = 1 tun.

1 bushel = 4 pecks = 8 gals. (dry measure).

Liquid Measure.

2 pints = 1 quart.	$1\frac{1}{3}$ hogshead = 1 punch.
4 quarts = 1 gallon.	$1\frac{1}{2}$ punches = 1 pipe.
43 gallons = 1 tierce.	2 pipes = 1 tun.
63 gallons = 1 hogshead.	

Avoirdupois Weight.

16 drachms = 1 ounce.	28 pounds = 1 quarter.
16 ounces = 1 pound.	4 quarters = 1 cwt.
14 pounds = 1 stone.	20 cwt. = 1 ton.

Paper.

24 sheets = 1 quire.
20 quires = 1 ream.
2 reams = 1 bundle.
10 ,, = 1 bale.

Drawing Paper.

Demy = 20 in. × 15 in.
Medium = 22 in. × 17 in.
Royal = 24 in. × 19 in.
Imperial = 30 in. × 21 in.
Elephant = 27 in. × 23 in.
Double elephant = 40 in. × 26 in.
Antiquarian = 52 in. × 31 in.

Water.

1 gal. of water = 10 lb.
1 ft. cube ,, = 62½ lb.
1 ft. ,, ,, = 6¼ gallons.
1 ton of water = 36 ft. cube.
1 ,, ,, = 1⅓ yd. cube.
1 ,, ,, = 224 gallons.

Miscellaneous.

12 dozen = 1 gross.
A firkin = 1·44 cubic feet.
A fodder of lead = 2,184 lb.
A faggot of steel = 120 lb.
A pig of ballast = 56 lb.
A bushel = 1¼ ft. cube.

A ton of coal occupies	42	cubic feet.
,, coke ,,	82	,,
,, hay ,,	500	,,
,, straw ,,	1,200	,,

Rainfall.

Average rainfall of United Kingdom = 32 in. per annum.
1 in. rainfall = 22,622 gals. per acre.
,, ,, = 3,630 ft. cube per acre.

Horse-Power.

Horse-power (H.P.) = 33,000 lb. raised 1 ft. high per minute.
or = 550 lb. ,, ,, second.

Drainage:—Average Thickness and Weight of Drain-Pipes.

Diameter.	Net length when laid.	Thickness of Pipe.	Depth of Socket.	Thickness of Socket.	Weight per Pipe.
4-in. stoneware......	2 ft.	$\frac{5}{8}$ in.	$1\frac{1}{2}$ in.	$\frac{5}{8}$ in.	18 lb.
6-in. ,, ...	2 ,,	$\frac{11}{16}$,,	$1\frac{3}{4}$,,	$\frac{11}{16}$,,	28 ,,
9-in. ,, ...	2 ,,	$\frac{13}{16}$,,	2 ,,	$\frac{13}{16}$,,	53 ,,
4-in. cast-iron	9 ,,	$\frac{3}{8}$,,	3 ,,	$\frac{11}{16}$,,	$1\frac{1}{2}$ cwt.
6-in. ,, ...	9 ,,	$\frac{7}{16}$,,	$3\frac{1}{2}$,,	$\frac{13}{16}$,,	$2\frac{1}{2}$,,
9-in. ,, ...	9 ,,	$\frac{9}{16}$,,	4 ,,	$\frac{13}{16}$,,	$4\frac{1}{2}$,,

Fall.

Rule.—Multiply diameter of pipe in inches by 10, and the result will give self-cleansing gradients. Thus:—

Fall of 4-in. pipe should be 1 in 40.
,, 6-in. ,, ,, 1 in 60.
,, 9-in. ,, ,, 1 in 90.
,, 12-in. ,, ,, 1 in 120.

Self-cleansing gradients mean a velocity of 3 ft. per second when the depth of sewage is one-fourth diameter of pipe, which is reckoned as the normal quantity ordinarily passing through domestic drains.

The *maximum* discharge, however, is obtained when the depth of the flow is about $\frac{11}{12}$ths of the diameter of pipe, and not when flowing full, as might be supposed.

Pipe Tests.

The following tests are usually specified, the rule being a head of 1 ft. = pressure of ·43 lb. per square inch :—

	Head of Water.	
Stoneware drain-pipes to a	25 ft., or	11 lb. per square inch.
Cast-iron ,, ,,	200 ft., ,,	87 lb. ,,
Cast-iron gas-pipes ,,	300 ft., ,,	130 lb. ,,
Wrought-iron water-pipes to a	400 ft., ,,	174 lb. ,,
Cast-iron ,, ,,	600 ft., ,,	260 lb. ,,

Coal.

Anthracite coal weighs	55 to 60 lbs.	per ft. cube.
Bituminous ,, ,,	50 to 53 lbs.	,,
Newcastle ,, ,,	about 80 lbs.	,,
Welsh ,, ,,	,, 84 lbs.	,,

Coke.

1 sack	=	4 bushels.
1 chaldron	=	12 sacks.
1 score	=	21 chaldrons.
1 ft. cube	=	47 lbs.

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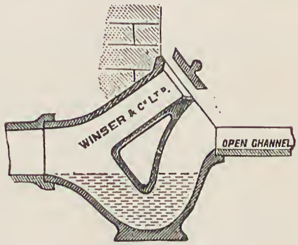

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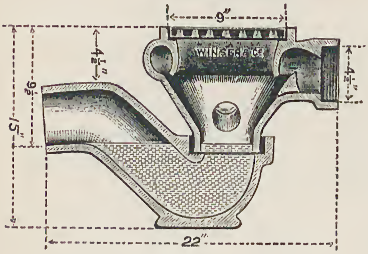

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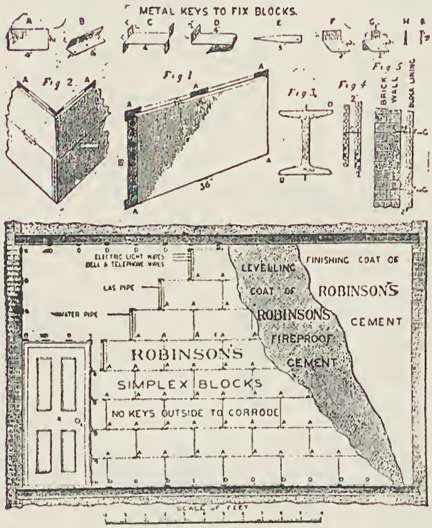

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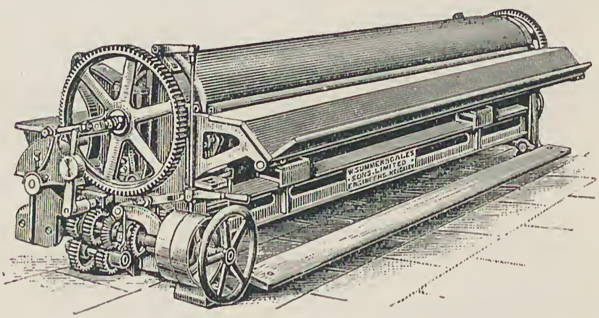

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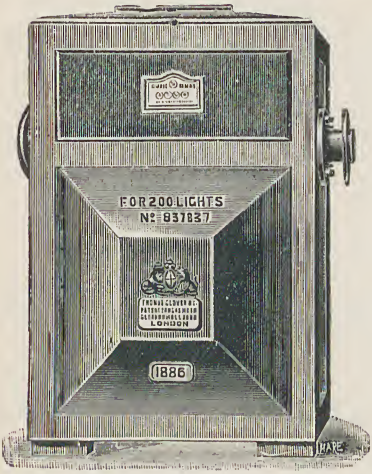

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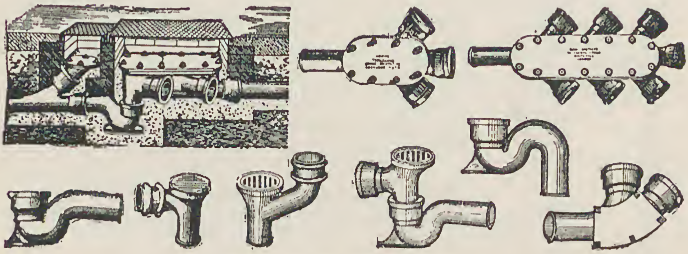

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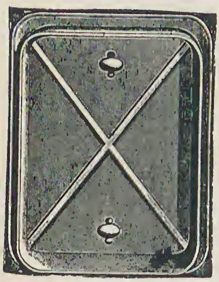

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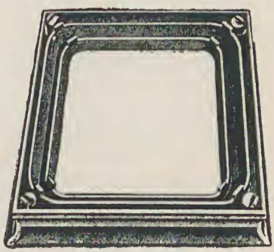

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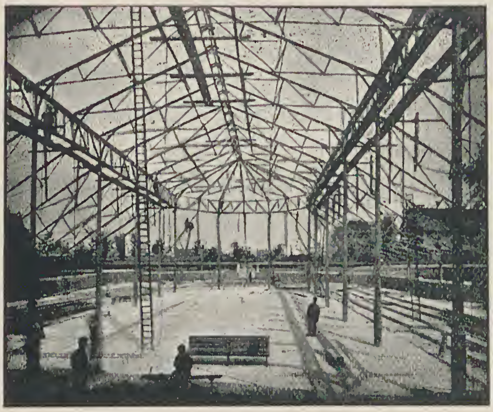

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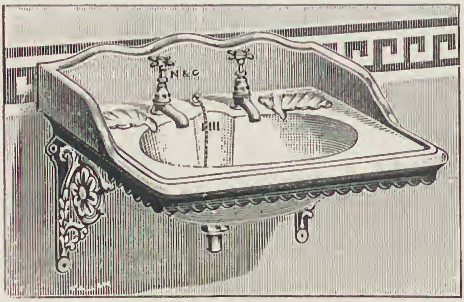

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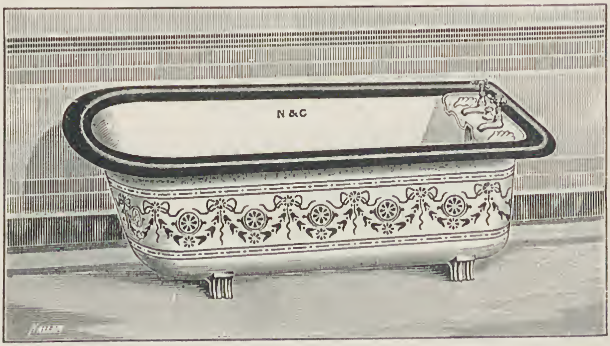

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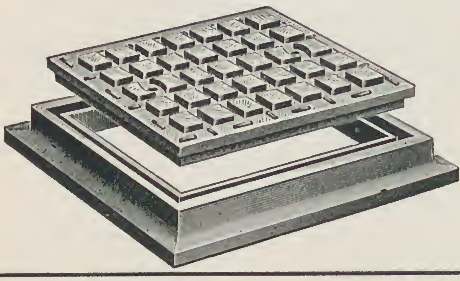

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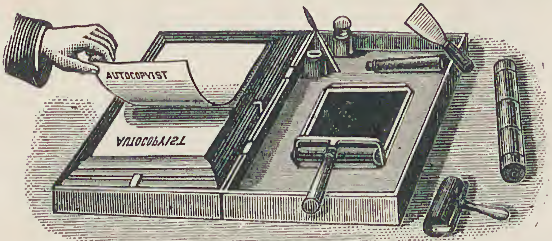

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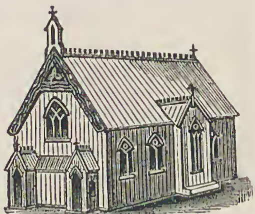

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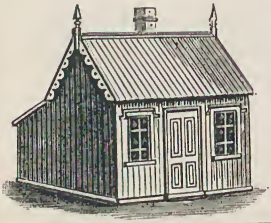

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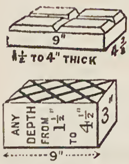

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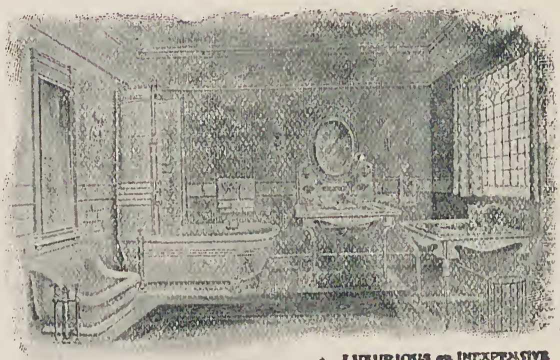

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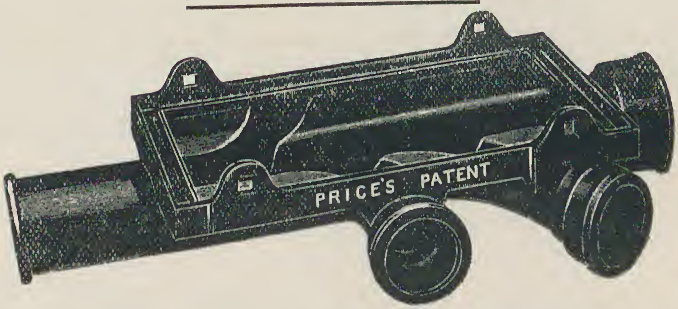

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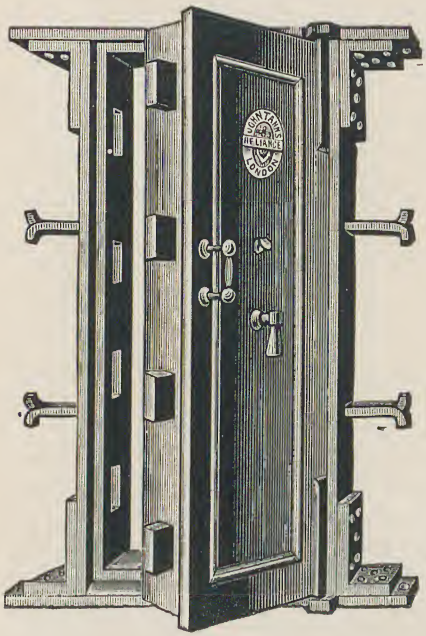

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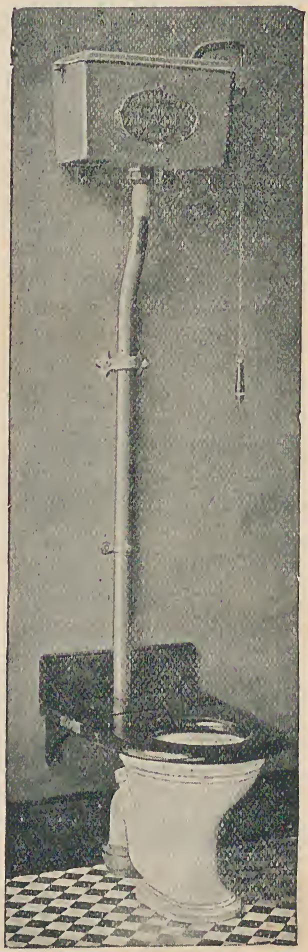

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